1. INTRODUCTION

On behalf of Vulcan Materials Company, Western Division (Vulcan), The Leu Group (TLG) has prepared this Site Investigation Report on the collection of soil vapor, soil matrix, and groundwater samples at the property formerly subleased by Industrial Asphalt (IA) at 9010 East Santa Ana Canyon Road in Anaheim, California (the Site).

The Irvine Land Company LLC (TILC) owns the property which encompasses the former Industrial Asphalt site. The Irvine Land Company's property contains approximately 3,001 acres that is currently undeveloped. The former Industrial Asphalt area (the Site) of this investigation occupies only ~2.1 acres of this vast tract.

The Irvine Land Company (predecessor in interest to The Irvine Land Company LLC) granted a license to Owl Rock Products Company to conduct surface mining operations on an approximate 300-acre area. Owl Rock Products assigned its license to New Owl Rock Products, who in turn assigned the license to Robertson's Ready Mix, LTD (Robertson's). Other entities such as All American Asphalt (under a sublicense to Robertson's Ready Mix, LTD) and Industrial Asphalt (under a sublicense first under New Owl Rock and then Robertson's Ready Mix, LTD) also had a presence. Of the 2.1 acres Site sublicensed to IA, IA occupied the southern portion of the Site and RF White occupied the northern portion by license from IA.

This Site Investigation Report (SIR) has been written to report the collection of data necessary to complete the site evaluation that has taken place at this site over the recent years. These data were collected to address DTSC concerns and allow for a residential-based risk assessment of the site to be conducted. Except as noted, the data was collected following a *Site Investigation Work Plan* (The Leu Group, 2006) reviewed and conditionally approved by the Department of Toxic Substances Control.

2. FACILITY INDENTIFICATION

The former IA Anaheim Hills site is located at the southern end of East Santa Ana Canyon Road in Anaheim, California. **Figure 1** is a Site Location Map. The facility is roughly triangular in shape. Pertinent identification information regarding the facility is:

OWNER/CONTACT: Vulcan Materials Company
3200 San Fernando Road
Los Angeles, CA 90065
Contact: Brian Anderson

Telephone: (323) 258-2777

EPA ID No. None

FACILITY ADDRESS: 9010 East Santa Ana Canyon Road,
Anaheim, California

CONSULTANT: David J. Leu, Ph.D.
President
The Leu Group
33725 Magellan Isle, Suite 100
Monarch Beach, CA 92629
Telephone: (949) 248-5873

2.1. PURPOSE

The purpose of this SIR is to provide DTSC the results of a detailed investigation of the subsurface beneath the site. This SIR fills existing data gaps with soil matrix, soil vapor, and groundwater sampling results from beneath strategic locations at site. These new data has been used to evaluate the threat to State waters and to determine if the site poses a risk above acceptable levels for residential development.

2.2. KEY PERSONNEL

Mr. Brian Anderson represents Vulcan Materials Company for this site. Vulcan Materials Company has retained The Leu Group (TLG), and specifically it's Principal, David J. Leu, Ph. D., as its consultant on this project. Dr. Leu acted as the Project Manager, and was the primary contact with the DTSC, and directed regulatory and technical aspects of the project, Dr. Leu reported directly to Mr. Anderson.

Mark Slatten, RG/CEG, CHG/RGP is TLG's Director of Field Operations. Mr. Slatten was responsible for managing all field operations. Mr. Slatten reports directly to Dr Leu.

Dr. Linda Henry of Brown and Caldwell directed the risk assessment work for this project. Dr. Henry reported directly to Mr. Anderson of Vulcan Materials Company but work very closely with Dr. Leu.

3. CURRENT CONDITIONS

Information provided in the Current Conditions section of this report is intended to provide the overall facility information that is presently known. Specifically, it provides information regarding background, site history, environmental setting, geology and hydrogeology, and prior investigations and remediations. It also provides information on the areas of known or suspected releases, chemicals of concern, the potential migration release mechanisms, potential receptors of concern, and the interim mitigations measures that were performed historically.

3.1. SITE BACKGROUND

The site is located at 9010 East Santa Ana Canyon Road in Anaheim, California. Until the City of Anaheim annexed the area in 1993, the address was 24000 Santa Ana Canyon Road. This area is at the entrance to Gypsum Canyon, a generally undeveloped area south of the Riverside (91) Freeway. The site is approximately 0.2 miles south of the entrance to the former Owl Rock Plant. Owl Rock formerly mined rock (aggregate used in construction materials) immediately east of the Site.

3.2. SITE HISTORY

The Griffith Company built an asphalt batch plant and began operations in the late 1950s IA acquired the manufacturing operations in the 1970s. Batch asphalt manufacturing consists of mixing hot asphalt oil with hot aggregate in a pug mill. The material was immediately loaded into trucks for transport off-site while the asphalt was still hot. Asphalt oil, which was heated to retain mobility, was stored in three 10,000-gallon-capacity underground tanks. Aggregate was provided by Owl Rock and was stored on the southeastern portion of the Site prior to use in the production of asphalt. Asphalt was top-loaded into trucks from the batch plant for transport to construction sites. Initially, two underground storage tanks (USTs; 7,500 gallon- and 10,000 gallon capacity) were used to store diesel fuel oil used to heat the rotary dryer at the batch plant. In 1989, the initial two diesel USTs were removed and replaced by a 12,000-gallon-capacity diesel UST. In December 1995 plant decommissioning was initiated. All physical structures were removed and the site was re-graded (WEC, 1996).

The RFW facility operated as fueling center and truck storage location. Two 6,000-gallon-capacity USTs were used to store diesel fuel until they were removed in 1990. Based on a hazardous materials management submittal to the Orange County Health Care Agency (OCHCA), one of the tanks reportedly stored gasoline fuel for a period of time (WEC, 1996). The date or duration of the reported gasoline storage is not specified in the submittal.

3.3. *ENVIRONMENTAL SETTING*

The following sections describe the environmental setting related to the Site. Information provided herein is based upon experience in the Site vicinity and review of agency files/records, as well as review of pertinent environmental and geological reports. Environmental data included in this SIWP includes discussion of land use, zoning, demographics, local habitat and ecology, topography and surface drainage, climate, and surface waters

3.3.1. Land Use, Zoning, and Demographics

Information presented in this section is based on field reconnaissance, review of aerial photographs, and review of relevant planning documents as identified herein.

The 2.1-acre IA site is part of a track of land owned by TILC. The TILC property encompasses approximately 3 3,001 acres that is currently undeveloped. The Site, which is a small parcel of a much larger property (~300 acres) subleased by TILC to Owl Rock Products Company (Owl Rock) and Robertson's. IA operated at the Site under sublicense initially to New Owl Rock and later to Robertson's. IA occupied the southern portion of the 2.1-acre Site and R.F. White Trucking Facility (RFW) operated on the northern portion under sublicense from IA.

Additional Site disturbance is associated with unimproved roads that traverse the Site and prior cattle grazing.

3.3.1.1. Surrounding Land Uses

The TILC property (and the Site) is located within the City of Anaheim's Hill and Canyon Community Policy Area as designated in the Anaheim General Plan. As stated in the City of Anaheim General Plan Land Use Element "The Hill and Canyon Area is home to thousands of hillside residents and one of Orange County's most desired communities. Scenic views, well planned residential development, access to a variety of natural, scenic and recreational resources, like the Santa Ana River, Deer Canyon Park Preserve, and the Anaheim Hills Golf Course, all contribute to the sense of pride felt by area residents."

The Site is surrounded by existing development to the west and north within the cities of Anaheim and Yorba Linda, respectively. The areas to the east and south of TILC property are undeveloped open space areas with the exception of an approximate 15-acre parcel designated for residential uses, owned by Robertson's that is located directly southeast of the quarry lease area. The following is a description of the existing and planned land uses surrounding IA's property.

3.3.1.1.1. North

The TILC property, the Riverside Freeway (SR-91), Featherly Regional Park, Santa Ana River and various residential, commercial, and institutional uses in the City of Yorba Linda are located north of the Site. The TILC property, SR-91, Featherly Regional Park, and the Santa Ana River provide a significant buffer between Site and existing development within the City of Yorba Linda on the north side of SR-91. The closest boundary of the Featherly Regional Park is approximately 1,500 feet from the project area and the nearest residence north of the site is at a distance of approximately 0.79 miles.

3.3.1.1.2. West

The area immediately west of the Site property owned by TILC and is not developed. To the west of this land is Route 241, a multi-lane toll road that is controlled access. To the west of Route 241 is within the Hill and Canyon Area of the City of Anaheim and is developed primarily with residential uses; specifically the communities of Sycamore Canyon and The Summit of Anaheim Hills. The nearest residence west of the site is at a distance of approximately 0.56 miles (~2960 feet) from the project area. The nearest school is the Running Springs Elementary School which is approximately 0.86 miles (~4540 feet) due west from the project area.

3.3.1.1.3. East

The area immediately east of the Site is owned by TILC and included the former Robertson's/Owl Rock site which was mined for aggregate. East of the TILC property is undeveloped and is part of the Coal Canyon Biological Corridor.

3.3.1.1.4. South

The area immediately south of the Site is owned by TILC and includes a portion of the area that was leased to Robertson's/Owl Rock and mined for aggregate. Further south is The Nature Conservancy Anaheim Conservation Easement (TNC ACE) consisting of undeveloped open space. South of the TNC ACE is open space within the Natural Communities Conservation Plan/Habitat Conservation Plan (NCCP/HCP) Reserve. Windy Ridge is a regionally prominent ridge line located south of the project site in the NCCP/HCP Reserve.

3.3.1.2. Future Land Use and Zoning

The Land Use Map included in the recently approved City of Anaheim General Plan designates TILC property (and the Site) for Low Medium Hillside Density Residential (0 to 6 dwelling units per acre), Low Medium Density Residential (0 to 16 dwelling units per acre in the Mountain Park Specific Plan area), and Open Space land uses. In addition, the Land Use Map designates a small portion of TILC's property for Institutional uses (northwest of the Santa Ana Canyon Road/Gypsum Canyon Road intersection) and shows areas for a General Park Location and a General School Location. The Site is within the Hill and Canyon Community Policy Area.

The Site has a current zoning designation of Mountain Park Specific Plan (SP 90-4). Section 18.112 of the City's Zoning Code includes the current zoning for the site based on the currently approved Mountain Park Specific Plan (SP 90-4).

The Mountain Park Specific Plan area is also included in the City's Scenic Corridor (SC) Overlay Zone described in Section 18.18 of the Zoning Code. The SC Overlay Zone provides guidelines for tree preservation and sets forth requirements and standards for residential, commercial, industrial, as well as public and special purpose zones within SC Overlay Zone boundaries.

3.3.2. Demographics

The nearest large city to the Site is Anaheim (population 334,000) and the nearest small city to the Site is Yorba Linda (population 60,000). The cities are strikingly different in their demographics. Anaheim's largest population segment is comprised of Hispanics (47%) who earn a medium income of $47,000 and live in houses with a medium value of $214,000. Yorba Linda's largest population segment is comprised of Whites (75%) who earn a medium income of $90,000 and live in houses with a medium value of $346,000. Anaheim grows in population by 7% each day due to commuters coming to work. Yorba Linda loses 26% of its population by commuters who drive an average of 30 minutes to work (many of them to Anaheim). Anaheim's population is 50/50 male and female, of which 69% have high school degrees (or higher). Yorba Linda has fewer males than females (49.1/50.9), of which 93% have high school degrees (or higher).

3.3.3. Archaeological Resources

The records search conducted for the proposed project show that TILC property has been surveyed a total of eight different times on various portions of their holdings; however only the study conducted for FEIR No. 302 included the entire site. None of these surveys identified any cultural or historic resources within the project site or off-site project areas. Within a half-mile radius beyond the study area, however, previous studies have identified 16 archaeological sites consisting of a birdbath, a historic structure, a canal, rock shelter, bedrock milling, and lithic scatters. Several isolated artifacts were also identified outside of the study area but within a one-half mile radius of it. Consultation of historic maps also identified one building within Gypsum Canyon in 1902 (USGS 1902) and four buildings within Gypsum Canyon in 1950 (USGS 1950).

Native American Heritage Commission (NAHC) files were reviewed, and Native American representatives were contacted as part of the cultural resources assessment1. Although the NAHC files did not indicate the presence of any traditional cultural properties within the study area, several Native American contacts described the Irvine Company property area as "culturally sensitive".

Pedestrian surveys conducted over the project site and off-site project areas did not reveal any archaeological resources. No trace of the buildings observed on the historic maps could be found. These results are consistent with the results of previous investigations in the region. The lack of evidence for human occupation may reflect the rough topography of the region and/or the burial of resources by alluvium in the canyon bottoms.

3.3.4. Paleontological Resources

The potential for discovery of fossils is an indication of the likelihood that excavation in a given rock unit identified as fossiliferous (fossil-bearing) could result in exposure of fossil resources. The potential for the discovery of fossils does not measure the significance of individual fossils present within the study area, because it is impossible to accurately predict what individual fossils may be discovered. The significance of an individual fossil can only be determined after it is discovered and studied by a qualified paleontologist.

A records search and literature review show that several fossil localities have been recorded on the TILC property. These include occurrences of poorly preserved unidentified bivalve mollusks and trace fossils from several exposures of the lower (marine) member of the Santiago Formation in the southern areas of the TILC project site (i.e., south of the IA Site). A locality just west of the mouth of Gypsum Canyon and atop the bluff along Santa Ana Canyon Road has produced partial to complete shells of marine bivalve mollusks and oysters, as well as a few shark teeth.

3.3.5. Habitat and Local Ecology

Gypsum Canyon and several tributary canyons, which occur within the Santa Ana Mountains, forms part of the northern end of the Peninsular Range geologic province. Because of the steep topography in this area, some portions of TILC property are uninhabitable (for human beings). Coastal sage scrub and lower chaparral habitats predominate in the region. These habitats have provided many important resources to local prehistoric inhabitants. Thick vegetation occurs in some areas, particularly along north-facing slopes and in narrow canyons. Vegetation is sparser along ridge tops and canyon bottoms, the areas most likely to have been occupied by humans. The Site has been used for cattle ranching. Regarding the IA parcel, the Site has recently been scrapped with approximately 5 feet of its surface soils removed. It is believed that TILC had its contractors due the scrapping in preparation of upcoming development activities. No evidence of animal habiting in the scrapped soil was observed.

3.3.6. Topography and Surface Drainage

The information presented in this section is based on the field reconnaissance, review of the site and aerial photographs, and a review of previous studies.

3.3.6.1. Landform/Topography

The Site is located at the bottom of Gypsum Canyon, in an area with numerous smaller northeasterly and westerly trending ridges and canyons. Existing elevations range from approximately 340 feet above mean sea level (amsl) in the northern portion to approximately 2,200 feet amsl in the southern portion of the Site. The ridges on-site, for the most part, are elongated with moderate to very steep side slopes ranging from 3: 1 to 1: 1 (horizontal to vertical). The sides of the ridges are often incised by swales and re-entrants from the canyons, which are generally narrow and V-shaped, with the exception of the main canyons, which are fairly wide and flat-bottomed. Existing elevations range from approximately 340 feet to 2,200 feet above mean sea level.

Major ridgelines within and surrounding the Site include Windy Ridge to the south.

Specific landform features that occur on-site are rock outcroppings. Rock outcroppings are defined as an area where natural undisturbed bedrock may be exposed, generally in areas that are too steep for colluvium to form.

3.3.6.2. Surface Drainage

Information presented in this section is based on the Mountain Park. Anaheim, California. Runoff Management Plan prepared by Fuscoe Engineering (February 2005).

The main portion of the project site consists of the major north trending Gypsum Canyon drainage, part of the Gypsum Canyon watershed. Waters from Gypsum Canyon ultimately drain into Reach 2 of the Santa Ana River. The Gypsum Canyon watershed is approximately 3,379 acres and is primarily natural with the exception of some modifications made by the sand and gravel extraction operations in the northeast corner of the watershed and the construction of SR-

241. The Gypsum Canyon watershed drains from south to north and ranges from approximately 340 feet above mean sea level (amsl) to 2,200 amsl with steep slopes ranging from 30 to 75 percent.

3.3.6.3. Drainage Facilities

The majority of flows originating from the Site drains north via Gypsum Canyon Creek towards the mouth of the canyon near the intersection of Gypsum Canyon Road and SR-91. At SR-91, runoff is conveyed under the freeway via an existing box culvert Downstream of SR-91, Gypsum Canyon Creek flows in an earthen channel through Featherly Regional Park to the Santa Ana River. Existing flood control facilities were designed to improve conveyance capacity of the Lower Santa Ana River to an approximate 190-year design storm protection level.

3.3.7. Climate

The Site has mild Mediterranean-type climate (semi-arid) year round. The temperature ranges from an average 58° F in winter, 68° F in the spring, 74°F in the summer, and 60°F in the fall. Precipitation in the form of rainfall peaks in February (3") and is almost non-existent from May to August. Yearly rainfall averages from 11- to 14" per year. Humidity peaks in September (80% in the morning and 55% in the afternoon) and is lowest in December (75% in the morning and 55% in the afternoon). The Site has more cloudless days in November (75% of the time) than in May and June (only 59% cloudless).

3.3.8. Surface Waters

The Site lies at the bottom of Gypsum Canyon in the floodplain of Gypsum Canyon Creek, which forms the western boundary of the Site. Gypsum Canyon Creek is an ephemeral stream with expected peak flow rates ranging between 1,030 cfs for the 2-year storm to 3,230 for the 25-year storm. During peak years of operation, Owl Rock (and Robinson earlier) conducted wash down operations that added significantly to the surface flow in the Creek.

3.4. GEOLOGY, HYDROGEOLOGY AND GROUNDWATER OCCURRENCE

3.4.1. Regional Geology

This section summarizes information provided in the *Updated Preliminary Geotechnical Investigation, Mountain Park Project, Gypsum Canyon. Orange County, California,* prepared by Leighton and Associates, Inc. (March 2005).

The Site is located in the northern foothills of the Santa Ana Mountains, which are included within the Peninsular Range geomorphic province of coastal Southern California and form the southeastern margin of the Los Angeles Basin. The bedrock units within the area of the Site represent marine and non-marine sedimentary strata of upper Cretaceous, Paleocene, Eocene, and Miocene ages. In order of oldest to youngest, these include the Ladd, Williams, Silverado, Santiago, Vaqueros-Sespe, and Topanga Formations.

3.4.2. Geologic Units

Geologic structure at the project site consists of bedrock formations of Tertiary and Cretaceous age. Alluvial materials, ranging in depth from five to greater than 50 feet in thickness, are present in beneath the Site. The potential for liquefaction exists due to the nature of the alluvial materials (i.e., relatively sandy) and the rare presence of high groundwater.

The structure beneath the Site is comprised of a homoclinal block transected by north-northwest trending bedrock faults. None of these bedrock faults underlie the Site.

Surficial geologic units consist of relatively recent alluvium, slopewash, landslides, and manmade fills.

All units are briefly discussed below.

3.4.2.1. Topanga Formation

The Topanga Formation of middle Miocene age consists primarily of a basal conglomerate overlain by well-cemented, light tan to gray, sandstone. Outcrops of this unit likely occur beneath the Site.

3.4.2.2. *Vaqueros-Sespe Formation, Undifferentiated*

The late Eocene to early Miocene age Sespe Formation is of continental non-marine origin It is comprised primarily of red colored sandstones and clayey sandstones, with some claystone, siltstone and conglomerate.

The middle Miocene age Vaqueros Formation is of marine origin and consists primarily of yellow sandstones with interbedded shales. This unit represents a marine transgression both interfingering with and overlying the continental Sespe Formation.

The interbedded relationships make these formations difficult to differentiate on a map, but they are generally distinguished in the field by the Sespe Formation's reddish color versus the Vaqueros Formation's yellowish color. Marine and non-marine strata of the undifferentiated Sespe and Vaqueros Formations are exposed east of the Site. On the east side of Gypsum Canyon, just south of the Santa Ana River, the sandstone and conglomeratic sandstone grades upward into a massive conglomerate. This was the site of the Owl Rock's sand and gravel mining plant.

3.4.2.3. *Santiago Formation*

The late Eocene Santiago Formation, exposed on the eastern portion of the project site, is mainly of marine origin. It is generally comprised of a basal conglomerate and is overlain by gray to buff, well-cemented sandstone interbedded with siltstone. The Santiago Formation is exposed along the extreme northern and eastern edges of Development Areas 2 and 5 as well as to the east and south of the project site.

3.4.2.4. *Silverado Formation*

The Paleocene age Silverado Formation is of marine and non-marine origin and is the oldest Tertiary unit within the project site. Non-marine strata of the Silverado Formation are exposed farther east of the Site and are comprised primarily of gray to yellow brown sandstone with interbedded siltstones and a basal conglomerate bed. These beds are overlain by the Claymont Clay Bed, which in turn is overlain by interbeds of sandstone, siltstone and conglomerates. The Silverado Formation is exposed northeast of the Site.

3.4.2.5. *Williams Formation, Shulz Ranch Sandstone Member*

Marine beds of the Schulz Ranch Sandstone are exposed in the extreme southeast portion of the Irvine Company property. They consist of white to yellowish brown well-cemented sandstone.

3.4.2.6. *Ladd Formation, Holz Shale Member*

The Ladd Formation is of upper Cretaceous age and represents the oldest bedrock unit mapped within the extreme southeast comer Irvine Company property. Marine strata of the Holz Shale Member of the Ladd Formation consist of thin- to thick beds of siltstone, sandy siltstone, and shale.

3.4.3. Surficial Units

3.4.3.1. Artificial Fill

Major fill deposits are associated with the former Owl Rock's sand and gravel mining plant. They are predominantly silts and clays derived from the quarry operations. Major fill deposits are also associated with the off-site grading of the adjacent development to the west. Minor fill is associated with access road construction, as well as existing and previously existing structures located within limits of the Site.

3.4.3.2. *Topsoil*

A mantle of sandy topsoil covers much of the Site. The topsoil is approximately one to two feet thick with thicker accumulations in swales. The nature of the topsoil changes depending on the parent material from which it was derived.

3.4.3.3. *Soil Creep*

Soil creep material consists of thin to thick sandy soil material (slopewash, topsoil, and weathered bedrock), which moves slowly downslope due to saturation during heavy rains and gravity. Soil creep material exists in the canyon side slopes.

3.4.3.4. Slopewash

The occurrence of slopewash and thick soil cover is generally found in canyons, swales, side slopes, and saddles. The term slopewash is synonymous with colluvium and may include alluvium. The composition of slopewash or colluvial materials is highly variable and controlled mainly by the composition of the underlying bedrock source. In general, these deposits consist of thick, sandy soil accumulations generally transported only short distances from their source.

3.4.3.5. Alluvium- Young Axial Channel Deposits

Alluvium represents an accumulation of sandy, coarse materials within canyons resulting from periodic stream transportation and deposition. As a result of transport, the alluvium generally tends to be thinner in the narrow canyons and thicker within the broader canyons and valley areas.

3.4.3.6. *Landslides*

The landslide materials are derived from slopewash and underlying bedrock as a result of translational or bedding plane failures and/or rotational failure and slumps. Landslide material exists in canyon side slopes. Three large landslide complexes have been mapped within or adjacent to the Site. A landslide complex is located within the limits of the Owl Rock sand and gravel site. The landslide is an active landslide that appears to have been activated due to ongoing mining activities.

There are numerous unexplored smaller landslides throughout TILC property that would require further investigation during subsequent stages of project development.

3.4.4. Regional Faults/Seismicity

The Alquist-Priolo Earthquake Fault Zoning Act was adopted by the State of California in 1972 to mitigate the hazard of surface fault rupture along active faults. For the purpose of this act, the State has defined an "active" fault as having "had surface displacement during Holocene time" (i.e. during the previous 11,000 years). In accordance with the Act, the State has delineated "Earthquake Fault Zones" along "active" faults throughout the State. The designated zone closest to the project site appears to be located roughly one to two miles to the north along the Whittier-Elsinore fault zone. The subject project site is not located within a designated "Earthquake Fault Zone."

Three mapped inactive faults lie within the boundaries of the Irvine Company property. These inactive faults trend to the north-northwest, but are not the Site. The bedrock structure and fault patterns represent past episodes of tectonic deformation. None of these faults mapped within the parcel are reported to be active or potentially active as defined by the Alquist-Priolo Special Studies Zone Act of 1972.

No known active or potentially active faults are shown crossing the site on published maps reviewed. No evidence of active or potentially active faulting was encountered in any of the exploratory excavations performed during Site investigations, or in referenced reports reviewed for this Work Plan.

There are a number of faults in the Southern California area that are considered active and could cause moderate to strong shaking should they be the source of an earthquake These include, but are not necessarily limited to, the San Andreas Fault, the San Jacinto Fault, the Elsinore Fault, the Whittier-North

Elsinore Fault, the Chino Fault and the Newport-Inglewood Fault Zones.

3.4.5. Local and Site Specific Geology

In general, the stratified rocks beneath the Site occur as the limb of a west dipping homocline. The rocks strike generally northeast to northwest and dip at moderate angles, 10 to 45 degrees, to the west and northwest. This bedrock structure represents past episodes of tectonic deformation.

The soils beneath the Site are at least 55-feet thick and have been penetrated to that depth on several occasions. The soils consist of poorly-developed layers of gravel, gravelly sand, and coarse- to fine-grained quartz sand intercalated with clayey and silty gravel, gravelly and silty sand, and sandy silt. Color ranges from brown sand and silt to yellow brown gravel. Cobble beds are common. Wood chips are common in the areas backfilled during previous investigations. Boring logs are provided in Appendix A.

3.4.6. Regional Hydrogeology and Groundwater Occurrence

Gypsum Canyon is located east of the Orange County Ground Water Basin and southwest of the Chino-Riverside Ground Water Basin, in the Gypsum Creek drainage of the Santa Ana River Watershed. The Santa Ana River Watershed drains to the Santa Ana Forebay of the main Orange County Ground Water Basin. The majority of regional ground water in the vicinity of the Site occurs in the alluvial sediments of the Santa Ana River with lesser amounts occurring in the bedrock and alluvium of the adjacent subsidiary canyons. Groundwater flow from the Site generally mimics surface water flow and flows into aquifers beneath the Santa Ana River. However, most recharge to the ground water in the alluvial sediments of the Santa Ana River comes from either the river's surface flow or underflow from the Chino Basin. Only minor amounts of recharge to the ground water beneath the Santa Ana River are derived from the aquifers of adjacent canyons

3.4.7. Local Hydrogeology and Groundwater Occurrence

Two aquifers have been identified in the area of the Site: a confined bedrock aquifer and an unconfined alluvial aquifer. The bedrock aquifer is sometimes, but not always, overlain by the alluvial aquifer.

3.4.7.1. Bedrock Aquifer

The confined bedrock aquifer occurs primarily in the upper Santiago Formation. Ground water in the bedrock locally occurs under artesian conditions with the water surface ranging from 20 feet below ground surface (ft bgs) near the mouth of the canyon (near Santa Ana River) to seven feet above ground surface in the central part of the canyon within the TILC property. Ground water in the confined bedrock aquifer flows in a northerly direction at a gradient of approximately 0.015 feet of drop per foot of horizontal distance based on ground water levels measured in bedrock monitoring wells GB-1 and GB-2 in March 2003. The rate of ground water movement in the bedrock aquifer (also called ground water seepage velocity) was estimated to be 0.4 foot/day.

Groundwater was encountered in several borings, specifically those drilled in areas underlain by alluvium and artificial fill. In these borings, conducted in 2003, groundwater was encountered between 18 and 55 feet below ground surface (bgs). On-site groundwater conditions are further discussed in Section 3.4.5 below.

The Earth Technology Corporation drilled a number of borings in 1984 for the purpose of locating the groundwater table in the main canyon of the Gypsum Canyon drainage. Their data indicates that both a confined bedrock groundwater aquifer and an unconfined alluvial groundwater aquifer exist in the main canyon. In the borings completed in 1984, the groundwater surface in the unconfined alluvial aquifer ranged between approximately 15 to 55 feet bgs. Artesian groundwater conditions have been identified within the Santiago Formation that may underlie the southern and eastern portions of the TILC property below the ground surface. The lateral extent of the artesian zone and its relationship to the entire project site appears to be confined to the Santiago Formation which crops out primarily in the southern and eastern portions of the TILC property, outside the limits of the IA Site. The bedrock groundwater potentiometric surface ranges from approximately 20 feet below the existing surface near the mouth of the canyon to approximately seven feet above ground surface near the central part of the canyon. Additionally, above- ground seepage areas have been recently observed within the existing quarry site (Development Area 5). This seepage is believed to be a naturally occurring, perched condition on a less permeable zone. Groundwater may be encountered during alluvial removals in the main canyon areas.

3.4.8. Facility Hydrogeology and Groundwater Occurrence

Groundwater in the alluvial portions of the Site is unconfined and occurs approximately 38- to 40 feet bgs, based on recent drilling data. Groundwater was measured to be 37.8 feet below the top of casing in monitoring well GB5. Recharge to the unconfined aquifer occurs through infiltration of precipitation and surface water in the drainages. Artificial recharge from surface-water storage reservoirs within the Robertson's Ready-Mix lease area may have raised groundwater to unnaturally high levels while these reservoirs existed. Seasonal precipitation patterns may result in wide fluctuations in groundwater levels in this aquifer.

Groundwater in the alluvial aquifer flows in a northerly direction at a gradient of approximately 0.015 foot/feet. The flow direction and gradient were estimated from ground water levels measured in alluvial aquifer monitoring wells GB-4 and GB-6 In March 2003. Ground water seepage velocity in the alluvial aquifer was estimated to be approximately two feet/day. The Mountain Park EIR states that the quarry operations used groundwater from a well in Featherly Park.

3.4.9. Historical Regional and Local Groundwater Quality

Ground water quality in the region is under the jurisdiction of the SARWQCB. Specific ground water quality objectives have been established by the SARWQCB and are summarized in the Santa Ana River Basin Plan. Basin-specific objectives have been established for constituents such as total dissolved solids (TDS) and nitrate. Water quality constituents for which basin plan objectives are not specifically identified in this plan are regulated according to their respective maximum contaminant levels (MCLs) or State of California Department of Health Services Action Levels. For water quality standards in the Basin Plan, such as the toxicity standard, MCLs are used as an alternative numeric benchmark in this chapter in the absence of a numeric standard.

Receiving waters for the region include Gypsum Canyon Creek and ultimately the Santa Ana River. The Water Quality Control Plan for the Santa Ana River Basin (the Basin Plan) lists beneficial uses of major water bodies within this region. Gypsum Canyon Creek is not specifically designated with beneficial uses in the Basin Plan, but the Santa Ana River is listed and has specific beneficial uses assigned to it. The Santa Ana River's is designated "P" for "present or potential beneficial uses" for agricultural supply waters, groundwater recharge, recreation involving bodily contact and possible ingestion, recreation involving non-contact with the water, warm freshwater habitat for warm water ecosystems, and waters that support rare, threatened, or endangered species and associated habitats. The Santa Ana River is excerpted ("E") as a municipal drinking water source.

3.4.9.1. Existing Receiving Water Quality

Water quality data at two monitoring stations in the Santa Ana River provided by the Orange County Water District (OCWD) are summarized in **Table 3.1**. These two monitoring stations include the following:

- Santa Ana River 0.9 mile below the Prado Dam (SAR-BELOWDAM-01) (5 miles upstream of the project site); and
- Santa Ana River at the Imperial Highway (SAR-IMPERIAL-01) (5.3 miles downstream of the project site).

The data in **Table 3.1** were taken from January 2000 through June 2003, at least once per month, but occasionally more frequently. Monitoring occurred on 73 dates at the Prado Dam location and on 61 dates at the Imperial Highway location during this period; however, the number of samples for each constituent was generally less than the total number of sampling dates and varied depending on the constituent. These data include both wet weather and dry weather sampling. The monitoring data reflects the effect of managed flows from the Prado Dam. For instance, TSS concentrations are much lower than those typically observed in uncontrolled river systems in Southern California. TSS does increase slightly from the Prado Dam monitoring station downstream to the Imperial Highway station. The relatively high nitrate levels (on average from 3.8 to 5.2 mg/L as N) reflect that the flows in the river above Prado Dam are dominated by tertiary treated wastewater. OCWD manages an extensive network of constructed wetlands behind the Prado Dam to reduce nitrate levels in the river to below drinking water standards (10 mg/L as N). The ratio of dissolved copper to total copper shows that most of the copper is in the/dissolved phase, which reflects the low TSS and turbidity concentrations. The high hardness values (averages ranging from 240 to 266 mg/L as $CaCO_3$) are typical of streams in Orange County.

Water quality data were also collected by the Orange County Environmental Management Agency (OCEMA) at a monitoring station in the Santa Ana River in close proximity to the Site. These data are outdated, as they were taken in the late 1970s and early 1980s, and do not appear to reflect current conditions in the Santa Ana River as affected by the operation of the Prado dam.

Water quality data were also collected by OCEMA at a monitoring station in Gypsum Canyon Creek once in March 1992 and once in March 1995 during low flow conditions. Hardness was measured at 230 mg/L as $CaCO_3$ in 1992 and 450 mg/L as $CaCO_3$ in 1995. Measurements of trace metals indicated a total copper concentration of 5 µg/L, a total lead concentration of 5µg/L, a total zinc concentration of 20 µg/L in 1992 and a dissolved copper concentration of 50 µg/L in 1995. Nitrate-nitrogen was not detected at the detection limit of 1 mg/L.

3.4.9.2. Historical Facility Groundwater Quality

Historical land uses within Gypsum Canyon have included cattle grazing, rocket testing, and clay, sand, and gravel mining. Mining operations have included Robertson's surface mine (gravel mining for cement and asphalt, later the Owl Rock Products facility) and several individual clay-mining operations associated with Pacific Clay Products. Ground water in the project site is not currently used for drinking water or irrigation.

Several underground storage tanks (USTs) have been associated with the Robertson's Ready Mix site. These include USTs for the storage of gasoline, waste oil, and diesel fuel. The majority of the USTs have been removed under oversight by the City of Anaheim and/or the Orange County Healthcare Agency (OCHCA) and/or the Santa Ana Regional Water Quality Control Board (RWQCB). Robertson removed all remaining USTs during quarry reclamation under supervision by OCHCA. Trace concentrations of hydrocarbons have been observed in ground water near the UST sites, but no constituents have been detected above their Maximum Contaminant Levels (MCLs) in ground water. Quarry reclamation activities by Robertson's included additional site assessment and remediation, where applicable, of residual hazardous substances associated with USTs in the quarry area.

Ground water quality impacts have not been detected beneath the Site in association with the McDonnell Douglas rocket fuel test site, which occupied the central portion of Gypsum Canyon. The site operated under the name of Astropower from 1966 to 1979 and tested various types of hydrazine, pentaborine and fluorine fuels at several test pads throughout the site. Activities included melting and forming solid propellants, testing solid propellants, and cleaning parts with chlorinated solvents. No underground storage tanks or pipelines were located at the facility with the exception of three septic tanks and leach lines.

In 1984, the Earth Technology Corporation collected ground water samples from six monitoring wells at the former McDonnell Douglas test site. The samples were analyzed for basic water quality parameters and total halogenated organic compounds. Halogenated compounds were detected in samples from two of the monitoring wells located downgradient of the test facility. Further sampling detected the following contaminants in the downgradient monitoring wells: methylene chloride, benzothiozole, carbon disulfide, isobutene, benzene, toluene, phenol, dimethylphthalate, trichloroethene (TCE), 1,1,1 trichloroethane (1,1, 1-TCA), 1,1-dichloroethene (1,1-DCE), and 1, 1-dichloroethane (1, 1-DCA). The Mountain Park EIR states that perchlorate has not been detected in any samples collected from monitoring wells within the Site area.

Recent ground water samples were collected from five wells in the vicinity of the former McDonnell-Douglas site, in November and December 2003. With one exception, no volatile organic compounds (VOCs), petroleum hydrocarbons, or perchlorate were detected. Samples from Monitoring Well GB-8 were found to contain TCE at concentrations of 18 ppb (November 2003) and 19 ppb (December 2003). These concentrations are in excess of the 5 ppb MCL for this compound. Recent samples collected from two additional wells downgradient of the former McDonnell-Douglas site, however, did not contain detectable levels of TCE. At no time have any constituents other than TCE been detected in excess of their MCLs in any ground water beneath the Site.

Current groundwater quality, as determined by the recent SIR, is described in **Section 6.0**.

3.5. PREVIOUS INVESTIGATION AND REMEDIATION ACTIVITIES

Soil investigation and remediation activities were conducted independently at the IA and RFW Facilities as described below. Groundwater monitoring was conducted at both facilities and is discussed in **Section 3.5.3** below.

3.5.1. Industrial Asphalt Facility

Following removal of the 10,000-gallon and 7,500-gallon USTs in 1989, GeoSec (WEC, 1996) collected three soil samples from the tank pit (NT-I, NT-2, and ST-I; **Figure 3-1**). Only one sample (NT-I) contained elevated concentrations of total petroleum hydrocarbons as diesel (TPHd), at a concentration of 2,360 mg/kg. Toluene, ethylbenzene, and xylenes also were detected in this sample.

In January 1990, GeoSec conducted further investigation of impacted soil from the USTs (WEC, 1996). Approximately 100 tons of affected soil to depths as great as 19 feet below ground surface (bgs) was identified, removed, and recycled at the asphalt plant. Five confirmation soil samples were collected following this remedial excavation. TPHd was detected at concentrations greater than 100 mg/kg in two samples (SP-4 and SP-5) collected near the asphalt batch plant. On May 23, 1990, OCHCA approved a request to leave TPHd-affected soil in place near the asphalt plant, but also required installation of groundwater monitoring wells. Based on results of groundwater monitoring, OCHCA issued a letter dated December 20, 1991 indicating no further action was required for the UST closure.

During a site visit in April 1990, a California Department of Fish & Game (CDFG) warden informed IA that they had to remove the asphalt along Gypsum Canyon Wash within 15 days or risk being shut down. IA removed a portion of the asphalt within this time frame. However, after the asphalt was removed, it was discovered that the warden did not have authority to shut down the operations and that a permit was required to remove asphalt from the stream bank. During a subsequent visit in May 1990, a different CDFG warden noted that asphalt and concrete pieces were still present along the stream bank adjacent to the IA facility and that the streambed appeared to be altered from its natural state. In January of 1991, the CDFG issued an arrest report to IA for polluting the Gypsum Canyon Wash streambed with asphalt and altering the streambed without a permit. IA contended that the asphalt and concrete present near the wash were already present when IA acquired the site from Griffith in 1977 and were not a result of IA's operations. A remediation plan was developed in February/March 1992, and IA removed the asphalt and concrete and graded the embankment between July 27 and August 12, 1992. The stream bank was revegetated between December 28, 1992 and January 5, 1993 with hydroseed and numerous plants and trees along the stream bank. Remediation of the stream bank was completed to the satisfaction of the CDFG, according to their letter dated November 23, 1992.

After operations at the plant ceased in December 1995, the remaining 12,000-gallon diesel UST, three 10,000-gallon asphalt USTs, and aboveground equipment were removed from the property. Based on cleanup levels of 100 mg/kg TPHd and non-detect (ND) for benzene, toluene, ethylbenzene, and xylenes (BTEX), excavation was initiated in the area surrounding the former batch plant (WEC, 1996). Using these criteria, over 17,000 tons of soil was excavated to depths as great as 35 feet. Three main areas totaling 10,200 square feet were excavated to an average depth of 25 feet (**Figure 3-1**; WEC, 1996). The excavated soil was thermally treated. Ten confirmation samples of the treated soil were analyzed and showed that the treatment was effective for TPHd (less than 76 mg/kg) and BTEX (all ND). Treated soil was placed back into the excavation and compacted. In its report, WEC (1996) indicated that petroleum hydrocarbons were left in place in soil beneath the water table and in a thin visible layer at 5 feet bgs beyond the southern limits of the excavation areas.

TPHd, total petroleum hydrocarbons as gasoline (TPHg), and BTEX concentrations were present in soil that remained in place beneath the water table. Although methyl tert-butyl ether (MTBE) results were reported in soil, MTBE false positive results are common by the analysis method used (EPA Method 8020) and no confirmation analyses were conducted. The affected soil beneath the water table was left in place assuming it did not represent a potential source of dissolved material to groundwater because:

- The material was characterized as a weathered diesel, which is not highly mobile in soil,
- Evidence of biodegradation was present,
- Aquatic toxicity tests for hazardous waste classification were negative, and
- Significant dilution was assumed to occur at the site from groundwater recharge (WEC, 1996).

A thin layer of oily material was left in place at 5 feet bgs below other layers of asphalt material and soil. Analysis of this material showed that concentrations of TPHd, TPHmo, toluene, ethylbenzene, xylenes, and/or polycyclic aromatic hydrocarbons (PAHs) (GS-l and SE-l) were present. A leachability study of the material was conducted using deionized water. However, the results of the study appear questionable based on detection of TPHd in the control sample.

In a letter dated October 23, 1996, the City of Anaheim Environmental and Safety Division (CAESD) issued a no-further-action (NFA) letter for the site based on the assumption that future site use was for parking or a roadway. The letter indicates additional investigation and/or mitigation may be required if future site use is different from that assumption.

Meeting notes dated March 19, 1997 from the Regional Water Quality Control Board, Santa Ana Region (RWQCB), indicated that the Site was used to store water for the Owl Rock facility. The exact location of water storage was not identified. No further action was required by the RWQCB, as water storage was not considered to affect remediated soil or the subsurface layer of oily material at 5 feet bgs.

3.5.2. RF White Facility

On July 5, 1990, two 6,000-gallon USTs were removed from the RFW facility. Jirsa Environmental Services collected four soil samples (FB-l, FB-2, TB-l, and TB-2) from the tank pit. TPHd concentrations in these samples ranged from 1300 to 16,000 mg/kg (Jirsa, 1990a; Table 4B). In addition, three groundwater monitoring wells (MW-l through MW-3) were installed at the site (see Section 4.3). In a letter dated August 13, 1990, OCHCA required additional work to assess the extent of affected soil associated with the USTs. A soil gas survey was conducted (Jirsa, 1990b), which apparently indicated the extent of petroleum hydrocarbons around the location of the former USTs; however quantitative analysis results are not provided in Jirsa's report. In 1991, Jirsa collected soil samples in association with monitoring well installation at locations near the former USTs. Soil samples from the boring for MW-l (**Figure 3-1,** identified as B-1 for soil sampling purposes) showed TPHd concentrations up to 4,610 mg/kg and low levels of ethylbenzene, toluene, and xylenes (Jirsa, 1992). Total recoverable petroleum hydrocarbons (TRPH) were not identified at the other three borings (B-2 [same location as MW-2], B-3 [same location as MW-3], and B-4).

Based on these results, a work plan for soil removal and groundwater evaluation was developed (SEM, 1993) and implemented in May and June 1994. Approximately 3,300 cubic yards of soil were removed from UST area and subsequently treated and replaced at the RFW Facility (State, 1994).

Confirmation samples of the treated soil were collected at a rate of 1 per 100 yards and indicated effective remediation of the soil for TPHd (less than 56 mg/kg) and BTEX (all ND). The excavation area is shown on **Figure 3-1**. Following further groundwater sampling, CAESD issued a NFA letter for the RFW facility in a letter dated January 21, 1997.

3.5.3. Groundwater Monitoring

Two groundwater monitoring wells (GWMW-I and GWMW-2) were installed in 1991 at the IA Facility at the south and north ends of the initial tank excavation (**Figure 3-1**). Two rounds of groundwater monitoring were conducted using these wells in 1991 and 1995. Analytical results for groundwater samples collected during both monitoring events were ND for TPHd, BTEX, and MTBE. Based on the initial sampling data in 1991, OCHCA issued a NFA letter dated December 20, 1991 for the IA Facility UST closure with concurrence from the RWQCB. These wells were destroyed after the second sampling event in 1995 during decommissioning of the IA facility.

Three groundwater monitoring wells were installed at the RFW Facility at and generally downgradient of the UST area (**Figure 3-1**). Results from sampling in 1991 indicated low concentrations of BTEX (up to 2.7 ug/l), TPHg (0.8 mg/l), and TPHd (1.2 mg/l) in the groundwater sample from MW-1, which was located at the former UST location. Lower concentrations of benzene, ethylbenzene, and xylenes (up to 0.08 ug/L) and TPHg (0.022 mg/l) were detected in the groundwater sample from MW-3. Results for MW-2 were all ND except for TPHd (0.02 mg/l). These wells were re-sampled in 1993. Results were generally consistent for MW -1 with the exception of the concentration of ethylbenzene, which was over 100 times higher than previously detected. Results for MW-2 and MW-3 were non-detect. MW-I and MW-3 were last sampled in 1996 (June and February/March, respectively); MW-2 could not be located. Results of the final sampling were ND for all petroleum hydrocarbon constituents. MW-I and MW-3 were destroyed in November 1996. Based on these results, CAESD issued a NFA letter for the RFW Facility dated January 21, 1997.

3.5.4. Conceptual Site Model (CSM)

Developing an initial CSM requires: (1) identifying potential contaminants and establishing background concentrations; (2) characterizing potential sources of contaminants; (3) identifying potential pathways for each source through groundwater, surface water and sediment, air, soils, and biota; (4) identifying human and ecological receptors under current and future land uses; and (5) assembling site maps, cross-sections, analytical results, source-pathway-receptor diagrams, and the supporting narrative.

Based on the data available for the Site, the contaminants of concern are listed below:

HISTORICALLY FOUND IN SOIL	HISTORICAL FOUND IN GROUND WATER
- TPH (gasoline)	-TPH (gasoline)
- TPH (diesel)	- TPH (diesel)
- TPH (tar)	- BTEX
- BTEX	- metals
- MTBE	
- PAHs	
- metals	

SUSPECTED IN SOIL	SUSPECTED IN GROUND WATER
- perchlorate	- perchlorate
- PCBs	

The suspected sources of these materials are as follows:

KNOWN OR SUSPECTED COMPOUND	SUSPECTED SOURCE
- TPH (gasoline)	- USTs
- TPH (diesel)	- USTs
- TPH (motor oil/tar)	- spread on roads for dust control
- BTEX	- USTs
- MTBE	- USTs
- PAHs	- USTs, motor oil/tar
- metals	- motor oil/tar
- perchlorate	- natural, rocket fuel manufacture
- PCBs	- transformers

Figure 3-2 shows a source-pathway-receptor diagram that summarizes potential pathways for each source through groundwater, surface water and sediment, air, soils, and biota. **Figure 3-2** also identifies human and ecological receptors under current and future land uses. What it shows is that the primary release mechanism is infiltration/percolation of most of the chemicals of concern into the vadose zone and, in some instances, through to groundwater. The impacted soil is a potential secondary source. Secondary release mechanisms include dust from the original site and from excavations, additional releases to groundwater because of high groundwater or storms, and storm water runoff either down

Gypsum Canyon Creek or as sheet flow off the floodplain surface. The pathways identified include wind, groundwater, and surface water and sediments. Exposure routes include ingestion, inhalation, and dermal contact. The receptors identified are humans (area residents and visitors) and biota (terrestrial and aquatic) TLG has determined that it is unlikely that humans would be receptors of groundwater via the exposure routes of ingestion, inhalation, or dermal contact. All other exposure routes to humans and biota should be further evaluated. This includes aquatic biota, which is ephemeral as is the Creek. Frogs and other aquatic biota become active when the Creek has water in it and so are subject to exposure.

4. SCOPE OF WORK

The following activities were conducted to complete a soil vapor survey, soil matrix sampling, and collection of groundwater grab samples. Descriptions of the work for activities used to complete the site investigation (pre-field activities, field activities, reporting) are presented below. All activities were overseen by a TLG California-registered CEG, who is also an RG, CHG, and GP (geophysicist).

4.1. PRE-FIELD ACTIVITIES

The pre-field activities consisted of a site visit, utility clearance, and update of the site-specific health and safety plan. TLG conducted a site visit to mark the proposed drilling locations. TLG notified Underground Services Alert (USA) of the planned drilling activities, and a TLG CA-registered geophysicist "cleared" drilling locations for buried utilities.

4.2. FIELD ACTIVITIES

With the documented fluctuations in static groundwater levels beneath the Site, TLG made the assumption that a "smear zone" may exist within the depths of 15 feet (bgs) to groundwater. To assess this possibility, six deep borings (HSA 1 through 6) to groundwater were drilled to evaluate soil, soil vapor, and groundwater at each of two previous UST tank farm locations at the Site (**Figure 3-1**). Soil matrix samples were collected every 5-feet of drill depth, or where a lithologic change occurred, using Encore™ samplers (USEPA Method 5035/8260B) for VOCs, and stainless steel tubes for PAHs (USEPA Method 8270) and metals (USEPA Methods 6010/7471A). Soil vapor samples from hollow stem auger (HSA) borings were, with a few exceptions, collected from native soil beneath the backfill (20-, 25-, and 36 feet below ground surface)[1].

[1] Groundwater was encountered at between 38 and 40 feet, bgs. It should be noted that the Site's surface appeared to have been graded by parties other than Vulcan Materials Company and approximately 5 feet of

Table 4-1 lists the HSA locations and depths at which soil vapor samples were collected.

The exceptions were due either to address a desire on DTSC's part to collect a 10-foot bgs soil vapor sample from within the backfilled material or because limited zones of moisture were encountered which precluded taking a soil vapor sample. To respond to DTSC's request, one location (HSA 4) within the backfilled material was sampled at 10 feet bgs for soil gas. An additional sample at 10 feet bgs was also collected at HSA 3 for comparison purposes. Limited zones of moisture were found at HSA 3 between 30 and 37 feet and at HSA 5 between 18 to 23 feet.

A groundwater grab sample was collected from each deep borehole (HSA 1 through 6). The Groundwater samples were analyzed for total petroleum hydrocarbons (TPH), as identified by carbon chain length (CCID), using USEPA Method 8015M. Each groundwater sample was also analyzed for VOCs (8260B, includes MTBE), metals (by USEPA Methods 6010/7471A), and perchlorate (USEPA Method 314.0). It should be noted that the six groundwater grab samples collected from the HSA borings were unfiltered. This was done to capture any potential organics that may have sorbed to the fine grain particles.

A groundwater sample was collected from an existing well (GB-5) north of the Site near the entrance gate. This sample was analyzed for the same constituents as the other groundwater samples.

Sampling protocols for the three media (soil vapor, soil and groundwater) are contained in **Appendix B**.

Ten additional soil vapor sample locations (DPT 1 through 10) were drilled to evaluate soil vapor outside the excavated and backfilled areas at the site (**Figure 3-1**). At each of these ten locations, soil vapor samples were collected at 5- and 15 feet bgs. A limited asphalt zone was encountered in borings DPT-5 (at 8 feet bgs), DPT-6 (at 5 feet bgs), and DPT-7 (at 6 feet bgs). Based on a request of DTSC, soil vapor samples were collected successfully below the asphalt in all three borings (see boring logs, Appendix A).

Soil vapor samples were delivered to a mobile laboratory on site immediately after each sample was collected. They were analyzed by gas chromatography using a mass spectrometer (GCMS) for USEPA Method 8260B analytes. The mobile laboratory conducted two purge volume tests prior to sampling. No VOCs were detected in either purge test and a default value of three (3) volumes was used for all sampling locations. Confirmation soil vapor samples were collected in 1-liter Summa™ canisters and were delivered using TLG chain-of-custody procedures to Associated Laboratories of Orange, California, a state-certified

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surface soils had been removed as part of the grading. Thus, depth to groundwater is reported from the ground surface, as it existed at the time of drilling (August 2006).

analytical laboratory. A choke-type flow regulator was used between the Summa™ canister and each probe to ensure that the flow rate was correct. The Summa™ samples were analyzed for volatile organics using USEPA Method TO-15. The holding time for Summa™ canisters is 72-hours and was met for all samples.

A list of chemicals of potential concern at the Site (COPCs) and other petroleum hydrocarbons and oxygenates in soil vapor that were reported is provided as **Table 4-2**. The two methods were used to provide quantitative results for all COPCs, since neither standard method addresses all of them. Oxygen, carbon dioxide, methane, and hydrogen sulfide were monitored using a standard multi-gas monitor (e.g., an Innova-ST by Thermo Electron Corporation). Method detection limits were 0.1 microgram per liter (ug/l) for VOCs and oxygenates, 10 ug/L (or less) for leak check compounds, less than 1% for oxygen and carbon dioxide, less than 500 ppmv for methane, and 0.5 ppmv for hydrogen sulfide.

Soil vapor was collected at sixteen (16) locations (10 on a modified 50-foot grid: DPT 1 through 10 and six deep boring locations: HSA 1 through 6). At the 10 DPT locations, soil samples were collected at depths of 1-, 5-, and 10-feet bgs and analyzed for PAHs (by USEPA Method 8310), CAM metals (by USEPA Methods 6010/7471A), and VOCs (USEPA Method 8260B, includes MTBE). At two (2) of these 10 locations, the soil was continuously cored to 15 feet bgs. A soil sample from one of the continuous cores (DPT-10@10') was collected 10 feet bgs for analysis of site-specific parameters that are inputs to the Johnson and Ettinger vapor migration model (1991) and published in spreadsheet form by DTSC. These parameters are:

- Soil moisture by American Society of Testing and Materials (ASTM) D2216;
- Total porosity by American Petroleum Institute (API) RP 40;
- Soil bulk density by ASTM D2397; and
- Matrix grain size.

At the 6 HSA locations soil samples were collected at depths of 1-, 5-, 10-, 15-. 20-, 25-, 30-, 35- and 40 feet bgs and analyzed for PAHs (by USEPA Method 8310), CAM metals (by USEPA Methods 6010/7471A), and VOCs (USEPA Method 8260B, includes MTBE).

At the four locations nearest the former transformer locations, soil samples at 1-, 5-, and 10 feet bgs were analyzed for PCBs (USEPA Method 8082).

Table 4-3 summarizes the sampling locations, analytes of concern, the detection limits, and the rationale for each location.

Quality assurance/quality control (QAQC) samples for VOCs included one trip blank per day of fieldwork, one equipment blank per day of fieldwork, one method blank sample (ambient air), and one duplicate per every 20 soil samples collected (5%).

5. RESULTS

Six deep borings to groundwater (approximately 40 feet bgs) were drilled to evaluate soil, soil vapor, and groundwater at each of two previous UST tank farm locations at the Site (**Figure 3-1**). Soil matrix samples were collected every 5-feet of drill depth and analyzed for VOCs (USEPA Method 5035/8260B), PAHs (USEPA Method 8270), and metals (USEPA Methods 6010/7471A).

Soil vapor samples from hollow stem auger (HAS) borings were, with two exceptions, collected from native soil beneath the backfill (20-, 25-, and 36 feet below ground surface). In HAS 3 and - 4, one soil vapor sample was collected from a depth of 10 feet bgs. Soil vapor samples were delivered to a mobile laboratory on site. They were analyzed by gas chromatography using a mass spectrometer (GCMS) for USEPA Method 8260B analytes. None of the COPCs (**Table 4-2**) were detected above reported detection limits in any of the soil, soil vapor, or groundwater samples analyzed (**Appendix C**).

Ten (10) confirmation soil vapor samples were collected in 1-liter Summa™ canisters and were analyzed for petroleum hydrocarbons using USEPA Method TO-15. Very low detections (ug/m3 range) of selected VOCs were reported in the TO-15 analyses conducted on the Summa canister samples. The results of the Summa™ canister soil vapor samples are presented in **Table 5-1**. The laboratory sheets are included as **Appendix C**.

Oxygen, carbon dioxide, methane, and hydrogen sulfide were monitored using a standard multi-gas monitor. None of these gasses were detected above the detection limits of 1% for oxygen and carbon dioxide, 500 ppmv for methane, and 0.5 ppmv for hydrogen sulfide.

A soil sample from one of the three continuous soil cores was collected at 5 feet bgs for analysis of site-specific parameters that are inputs to the Johnson and Ettinger vapor migration model (1991). These laboratory data sheets are included in **Appendix C**.

Groundwater grab samples were collected from the six deep borings and from groundwater monitoring well G5. All volatile and semi-volatile organics were reported as nondetect as was perchlorate. Selected heavy metals were reported in each sample. The grab samples, which were unfiltered, reported the highest heavy metals. The grab samples were unfiltered in an attempt to capture any volatile or semi-volatile organics that may have been sorbed to the fine-grained particulates. The heavy metal results are presented in **Table 5-2**.

6. RISK ASSESSMENT

Brown and Caldwell, Inc. was contracted to conduct a risk assessment for the site based on a residential use scenario. Dr. Linda Henry directed the risk assessment work. The risk assessment utilized the laboratory data reports generated by the fieldwork conducted by TLG.

A human health risk assessment (HHRA) was performed to assess potential impacts to future residents from exposure to chemicals in soil, groundwater and soil gas. This risk assessment was conducted in accordance with guidelines published by the United States Environmental Protection Agency (U.S. EPA) in the Risk Assessment Guidance for Superfund: Part A (U.S. EPA 1989) and Part B (U.S. EPA 1991) and supporting documents and guidelines published by the California Environmental Protection Agency (Cal/EPA).

Risk assessment is a formal process with six steps used to determine the likelihood that long term exposure to chemicals in environmental media, e.g. soil, could pose a concern to people in future residential development at the site. Risk managers use the results of HHRA to make decisions on whether action is needed to reduce any potential exposure.

- Section 6.1 Data Evaluation presents laboratory results for soil, groundwater and soil gas samples included in the HHRA and presents the chemicals of potential concern (COPCs) included in the risk calculations.
- Section 6.2 Exposure Assessment evaluates the ways that people could come into contact with the chemicals (exposure pathways) and the amounts of chemical that could be taken into their bodies (daily intake).
- Section 6.3 Toxicity Assessment evaluates the potential for adverse health effects for each chemical.
- Section 6.4 Risk Characterization combines the information on exposure and toxicity to estimate the likelihood of adverse health effects.
- Section 6.5 Uncertainty Analysis discusses areas of uncertainty in the risk assessment and assesses the level of confidence in the conclusions.

6.1 DATA EVALUATION

This section presents the data evaluation process used to select data for inclusion in the risk assessment and for identification of COPCs. An site-specific evaluation of arsenic data in accordance with DTSC criteria for selection of COPCs is also included (DTSC 1997),

6.1.1 SELECTION OF COPCS

Every chemical reported in at least one sample was included in the HHRA as a COPC. No chemicals were excluded based on comparison to background or other screening criteria.

The COPCs are shown on **Table 6-1** and summaries of the data included in the HHRA are presented in **Table 6-2** for soil (48 samples from the surface to 10 foot depth; hexavalent chromium was only analyzed for in one sample[2]), **Table 6-3** for grab groundwater (6 samples), **Table 6-4** for the monitoring well groundwater (1 sample), and **Table 6-5** for soil gas (10 samples[3]). A soil depth of the surface to 10 foot depth was used to represent the potential range of soil for potential exposure by future residents. The samples used for each data set are presented in Appendix D1.

In soil, the COPCs include 16 metals and one semivolatile organic chemical, chrysene. In the grab groundwater samples, the COPCs include 15 metals and in the monitor well sample, the COPCs include five metals. In soil gas, the COPCs include 25 VOCs.

In this HHRA, health risks are calculated for both the grab and monitor well groundwater samples. The grab groundwater samples were not filtered and so the metals could be present on soil particles. The monitor well sample is most representative of groundwater for future use as drinking water. At this time, groundwater is not used for as potable water supply or for irrigation water.

6.1.2 BACKGROUND EVALUATION OF ARSENIC

All metals are included as COPCs in the HHRA regardless of whether the concentrations are below ambient levels. A second risk calculation is done that excludes COPCs with higher risks that are found at concentrations below background. In soil, arsenic is the only inorganic that has higher risks and so arsenic was selected for further background evaluation.

The range of concentrations of arsenic in the four background samples (3.26 to 7.44 mg/kg) is slightly lower than the range of the 48 onsite samples (2.78 to 10.4 mg/kg) in the upper 10 feet used in the HHRA calculations. This difference is most likely due to a difference in samples size. Larger data sets have more samples located in the ends or tails of the distribution.

[2] Total Chromium was below the CHHSL screening criteria for hexavalent chromium for the remaining samples.

[3] These 10 samples represent the soil vapor samples collected in Summa canisters and analyzed by EPA Method TO-15. The remaining 44 soil vapor samples collected and analyzed by EPA Method 8260B all yielded nondetection at the method dection limit (MDL). The MDLs for EPA Method 8260B are higher than for TO-15, therefore, the TO-15 results were utilized in the risk assessment.

For this evaluation of arsenic, a DTSC policy that provides a criteria for determining whether a data set consists of multiple populations (suggesting contamination) or only a single population (ambient levels) was followed (DTSC, 1997). The policy recommends a multifaceted approach including; (1) distributional testing, (2) assessment of coefficient of variation and range, and (3) examination of probability plots.

6.1.2. COEFFICIENT OF VARIATION AND RANGE

DTSC criteria for one population include a range of detected values that is no more than two orders of magnitude (i.e., a ratio of the maximum to minimum value that does not exceed 100), and a coefficient of variation that is not greater than one. The coefficient of variation is equal to the standard deviation divided by the mean. The range of concentrations of arsenic (2.78 to 10.4 mg/kg) are less than one order of magnitude and the coefficient of variation is 0.36 mg/kg and therefore less than one.

6.1.3. DISTRIBUTIONAL TESTING

Results of distributional testing show that arsenic concentrations are lognormally distributed without removal of any high values. DTSC policy states that data which fit normal or lognormal distributions are frequently ambient levels from one population. The log-transformed arsenic data meet the Shapiro-Wilk normality test at a 5 percent significance level ($p = 0.0954$). DTSC policy states that trace metals typically follow lognormal distributions. Statistica (StatSoft, 2004) was used to conduct the Shapiro-Wilk tests.

6.1.4 PROBABILITY PLOTS

Probability plot of the arsenic concentrations are shown in **Figure 6-1**. The data were log transformed (natural log) prior to plotting because distributional testing showed that the data are lognormal. The arsenic concentration is plotted on the y-axis and the expected value if the data are normally distributed is plotted on the x-axis

The probability plot shows that the data closely follow the lognormal distribution, with only minor gaps and inflections. It is common for the tails of the distribution to depart from the line, and for minor gaps and inflections to occur in the data.

Although the fact that the data are lognormally distributed using the Shapiro-Wilk distributional testing indicates that there are no outliers in the data, a second method, Rosner's outlier test, was used to test values at the upper tails of the arsenic distributions. Rosner's test indicates that high values are not outliers, thereby providing additional evidence that the data represent single populations.

6.1.5 DATA EVALUATION FINDINGS

In conclusion, multiple lines of evidence suggest that arsenic soil concentrations represent single, ambient populations. The lines of evidence include summary statistics, distributional testing, probability plots and outlier tests. Arsenic was included as a COPC in the calculation of total risk but a second calculation of risk without arsenic is also presented.

6.2 EXPOSURE ASSESSMENT

The objective of the exposure assessment is to evaluate the ways that future residents could come in contact with COPCs at the site in the future. An exposure assessment is a three step process. First, the complete exposure pathways by which these people may be exposed are identified. Second, the chemical concentrations at the point of exposure, the exposure point concentration (EPC), and, third, the daily intake rates associated with each exposure pathway are quantified.

6.2.1 Exposure Pathways

An exposure pathway is the means by which a chemical moves through the environment from the source to a receptor. Exposure pathways are identified by analysis of the distribution of COPCs in the environment and the physical and chemical properties of each COPC. For a pathway to be complete, there must be a reasonable way for a receptor to come into contact with a chemical in soil, groundwater or air.

Future residents could come into contact with COPCs in any exposed soil. Contact with soil could include ingestion of soil, dermal contact and sorption of COPCs through the skin and inhalation of dust. Construction workers and utility maintenance or landscape workers could contact chemicals in soil also; however, the assumptions used for residential exposure are likely to be protective of these workers. This is because residents are assumed to contact the soil more frequently and for a longer period of time than these workers.

Soil gas samples represent VOCs from soil and groundwater that could migrate into air. Future residents could come into contact with VOCs in indoor and outdoor air. Indoor air is likely to represent the highest exposure as vapors in outdoor air will dissipate faster and are less likely to accumulate. Therefore, the indoor air exposure pathway is evaluated quantitatively and the outdoor air pathway is discussed qualitatively

Future residents could come into contact with COPCs through ingestion of homegrown produce; however, the future use of the property is unlikely to provide sufficient space for any homeowner to have a large garden. Any home grown produce is likely to be in small quantities and would not constitute a significant portion of the diet.

Future residents are unlikely to contact groundwater either through potable water use or irrigation. However, because the groundwater is classified as a source of drinking water, the use of groundwater as a source of potable water is included in this HHRA. When groundwater is used in a house, residents could ingest the water or inhale vapors from groundwater in the shower. However, VOCs were not reported in either the grab or monitoring well groundwater samples and, therefore, inhalation of volatiles while showering is not a completed exposure pathway.

Residential exposure by children and adults to COPCs is assumed to have the following completed pathways:

- Soil - ingestion, dermal contact, and inhalation of particulates in outdoor air;
- Groundwater from hypothetical future use as a potable water supply – ingestion,
- VOCs in soil and groundwater that migrate to indoor air – inhalation as estimated with soil gas data.

A conceptual site model is presented on **Figure 3-2**.

6.2.2 Quantification of Exposure

The final step in exposure assessment is to quantify exposure for each pathway to estimate the quantity of chemical that a person could potentially take into their bodies or daily intake. Exposure quantification is a two-step process, which involves estimating EPCs and estimating daily intake rates. The goal of exposure quantification is to identify the combination of exposure assumptions that result in the maximum exposure that may be reasonably expected to occur.

6.2.2.1 Exposure Point Concentrations

In accordance with U.S. EPA guidance, exposure is based on the average concentration of a chemical. However, there is uncertainty that any set of samples may or may not be representative of all the concentrations found at a site. To address this uncertainty, U.S. EPA recommends using the 95 percent upper confidence limit (95 percent UCL) of the average chemical concentration

(U.S. EPA 1989). The 95 percent UCL represents an upper bound limit of the average such that the true average will be lower.

In the groundwater monitor well sample and the soil gas samples, the maximum concentration was used. Soil gas represents the vapors that might migrate into a future building. Therefore, the maximum concentration is most representative for the residential buildings in the future.

In soil and the grab groundwater samples, an exposure point concentration (EPC) was calculated for each COPC using the U.S. EPA software ProUCL, Version 3.0 (U.S. EPA 2004a), as follows:

1. The distribution of the data was determined. Samples reported as "nondetect" were included as values with a concentration of one-half the detection limit. There were no limitations on the percentage of nondetects.
2. The Student's t-test was used to calculate the EPC for normal data, the Land equation for lognormal data, and the gamma value for data that fit a gamma distribution. The approximate Chebyshev limit was used for nonparametric data.
3. The maximum concentration was used as the EPC if the appropriate 95 percent UCL was greater than the maximum concentration.

The results of the ProUCL modeling are presented in Appendix D2 and are summarized on Tables 6-6 and 6-7 for soil and grab groundwater, respectively.

6.2.2.2 Daily Intake

Daily intake is the amount of a chemical that a person could take into his or her body averaged over the period that he or she could be exposed. Daily intake is estimated by combining variables including contact rate, body weight, exposure duration, and averaging time with the EPC. The calculation using these variables results in an estimate of daily intake for each exposure pathway.

Daily intakes for reasonable maximum exposure (RME) were calculated. The RME is intended to represent the upper end of exposure. **Table 6-8** presents the equations and exposure parameters that were used to estimate daily intake, or dose. Site-specific, U.S. EPA default, and Cal/EPA default values for exposure parameters and chemical specific input values were used in this risk assessment. The general equation for calculating intake is shown below:

$$D = (C \times CR \times EF \times ED) / (BW \times AT)$$

where

D = dose (milligrams per kilogram per day)

C = exposure point concentration (milligrams per kilogram [mg/kg])

CR = contact rate (kilograms per day)

EF = exposure frequency (days per year)

ED = exposure duration (years)

BW = body weight (kilograms)

AT = averaging time (days)

Dermal contact equations have additional exposure parameters of adherence and absorption factors. Adherence factors indicate the amount of soil that adheres to the skin. Absorption factors reflect absorption of the chemical from soil across the skin membrane. Per DTSC (1994) and U.S. EPA Region 9 guidance (2004b), the dermal absorption factors shown on **Table 6-9** were used in conjunction with toxicity values unadjusted for gastrointestinal absorption.

Concentrations of volatile COPCs in indoor air were estimated using soil gas data and the Johnson and Ettinger model (U.S. EPA 2000, 2004c). Modeling input and output for the Johnson and Ettinger model are presented in Appendix D3. Default model parameters were used, except for the following site-specific input values:

- soil gas sampling depth 152.40 centimeters (cm) (5 feet bgs)
- soil type loamy sand
- average soil temperature 23 degrees Celsius (site-specific)
- residential air exchange rate 0.66 (Murray and Burmaster, 1995)

6.3 TOXICITY ASSESSMENT

The toxicity assessment identifies toxicity values for each COPC and the type of effect each COPC is capable of producing. Toxicological effects fall into two categories: those that could potentially cause cancer (carcinogens) and those that cause other types of adverse health effects (noncarcinogens). **Table 6-10** presents the toxicity values for carcinogens and noncarcinogens. Toxicity profiles are presented in Appendix D4.

The toxicity value for carcinogenic effects is called a cancer slope factor (CSF). The potential for noncarcinogenic health effects is estimated using a toxicity value known as the reference dose (RfD). Chemicals that show a potential for both carcinogenic and noncarcinogenic health effects are assigned both CSFs and RfDs. Cal/EPA CSFs were used except when none were available; then; U.S. EPA CSFs were used.

Toxicity values are specific to the route of exposure (i.e., oral, inhalation or dermal routes). Oral toxicity values were used in a route-to-route extrapolation for dermal values consistent with practices by U.S. EPA Region 9 (U.S.EPA 2004b).

Exposures to lead in soil were evaluated by comparing the maximum concentration of lead in soil to the acceptable concentration in soil of 150 mg/kg. This value is protective for a combined exposure to lead in the air, drinking water, food and soil.

Toxicity values developed by Cal/EPA were used in the risk assessment. The Cal/EPA cancer slope factors for carcinogens are listed in the Office of Environmental Health and Hazard Assessment toxicity database, accessible at http://www.oehha.ca.gov/risk/ChemicalDB/index.asp.

For chemicals without toxicity values listed by Cal/EPA, the toxicity values were obtained from the table of PRGs published by U.S. EPA Region 9 (U.S. EPA 2004b) and confirmed by a review of the U.S. EPA Integrated Risk Information System (IRIS) database (U.S. EPA 2004d) and the U.S. EPA Health Effects Assessment Summary Tables (HEAST) (U.S. EPA 1997). The IRIS database and HEAST were also searched for toxicity criteria for chemicals not listed in the PRG table.

When no toxicity value was available for a chemical, a value for another chemical of similar structure or chemical class was assigned based on chemical or structural similarity. **Table 6-11** identifies chemicals without toxicity criteria and their chemical surrogates.

6.4 RISK CHARACTERIZATION

The final step in any risk assessment is the combination of daily intake and toxicity values to calculate potential health risks. Cancer and noncancer risks are quantified separately. The risks are summarized in **Table 6-12** and the highest risk chemicals (risk drivers) for each pathway are presented in **Table 6-13** for carcinogens and **Table 6-14** for noncancer hazards. Risk calculations are presented in Appendix D5.

6.4.1 Overview of Risk Evaluation

Cancer risk represents the probability that exposure could result in an increased risk of cancer for the hypothetical receptor (e.g., a resident) during his or her lifetime. Cancer risk is termed "the probability of increased individual excess cancer." This means the risk over and above everyone's baseline risk of cancer. Cancer risk is a statistical probability, and does not predict how many cases of cancer will occur. The following equation is specified in the U.S. EPA Risk Assessment Guidance for Superfund (U.S. EPA 1989) for estimating cancer risk:

$$\text{cancer risk} = \text{daily intake} \times \text{CSF}$$

The cancer risks are added across all the exposure pathways for each chemical and then across chemicals to estimate overall risk.

The total cancer risk including naturally occurring metals at concentrations below background are presented as well as the incremental cancer risk. The incremental cancer risk does not include metals with a cancer risk above 1 x 10-6 that are found at concentrations within the range of California background.

The noncancer hazard associated with exposure to a chemical is called the hazard quotient (HQ), which is the ratio of daily intake to RfD. An HQ value of 1 or less indicates that lifetime exposure is less than or equal to the RfD and there is limited to no potential for causing an adverse effect in sensitive populations over a lifetime of exposure. The sum of chemical-specific HQs is called a hazard index (HI). It is appropriate to add HQ values for different chemicals only if they affect the same target organ. Adding HQ values into a single cumulative HI value across chemicals is a preliminary estimate of the highest possible noncancer risk. HI values of less than 1 are considered acceptable. Values greater than 1 are usually given closer attention. The following equation is specified for estimating noncancer risk (U.S. EPA 1989):

$$\text{noncancer risk} = \text{daily intake} / \text{RfD}$$

6.4.2 Cancer Risk Results

Cal/EPA uses a risk management range of 1 in 1,000,000 (1 × 10-6) to 1 in 10,000 (1 × 10-4) for potential carcinogens. Cancer risks below this range, e.g., less than 1 × 10-6, are considered negligible. Risks between 1 × 10-6 and 1 × 10-4 are evaluated on a case-by-case basis when making decisions about whether or not action is required to reduce risk. The following sections present the cancer risk characterization results.

The total cancer risk (including naturally-occurring metals at concentrations within background) is 1 × 10-1 for all pathways using the grab groundwater samples and 3 × 10-3 using the monitoring well sample. In the grab groundwater samples, the only carcinogens are arsenic and cadmium and in the monitoring well sample, the only carcinogen identified is arsenic

As discussed in Section 5, the concentrations of arsenic in soil and groundwater are ambient. There is no evidence of a release of arsenic either based on historic activities or evaluation of the site data. Also, the metals in the grab groundwater samples are most likely due to particulates. Arsenic concentrations in the downgradient monitoring well are much lower and cadmium was not reported.

The cancer risk using the monitoring well sample and removing arsenic from soil and groundwater is 6 × 10-7 and below a level of significance.

6.4.3 Noncancer and Lead Results

The total noncancer hazard value (including metals at background concentrations) is above the risk management range at 500 using the grab groundwater samples and at 6 using the monitoring well sample. The noncancer hazard value using the monitoring well sample and removing arsenic from soil and groundwater is 1 and at the risk management level of 1. Therefore, the noncancer risk is insignificant.

The maximum concentration of lead of 35.3 mg/kg is well below the acceptable concentration of lead of 150 mg/kg for a child resident.

6.5 UNCERTAINTY ANALYSIS

Varying degrees of uncertainty exist in each step of the risk assessment process. Risk managers take uncertainty into consideration when making decisions on risks within the risk management range. Decisions on sites with lower levels of uncertainty could be different than decisions on sites with minimal amounts of information and large data gaps.

6.5.1 Data Evaluation

There is a substantial amount of information and the risks are calculated in a protective manner so that there is a low level of uncertainty. The site has been well characterized and the findings are consistent with historic uses of the site. The potential is very low that there are any impacts that have not been characterized sufficiently to support this HHRA and any risk management decisions.

6.5.2 Exposure Assessment

Uncertainties are also associated with the parameters presented as exposure and in the quantification of exposure. In risk assessment, the actual exposure concentration is the average concentration that an individual could be exposed to over his or her lifetime.

It is likely that the risks outside the risk management range associated with indoor air are over-estimated. The maximum concentration found in any sample was assumed to present in one hypothetical sample and all the soil gas under home was assumed to be impacted at the maximum concentration for 30 years.

The risks to outdoor air, in our experience, are generally one to two orders of magnitude below those in indoor air. There is variability due to site-specific factors such as the size of the source areas and wind speed. Also, outdoor air exposure estimates would be most appropriately based on a 95% UCL rather than a maximum concentration. Qualitatively we can be confident that the outdoor air risks will be lower than the indoor air.

It is also likely that the risks associated with direct contact with soil (ingestion, inhalation of particulates and dermal contact) are over-estimated because daily contact with impacted soil was assumed in this HHRA. New residential developments in this area tend to not have yards for individual homes. Most of the soil is covered with hardscape or landscaped, often using imported soil. There could be community play areas, but typically soil or special groundcover is imported for these areas.

6.5.3 Toxicity Assessment

There is uncertainty associated with cancer slope factors and reference doses because these values are extrapolated from data on high dose exposure to laboratory animals to low level exposure to people. U.S. EPA toxicologists use protective methods to derive the factors so uncertainty is accounted with the best available science.

For this risk assessment, there were toxicity factors assigned to all chemicals detected. In the absence of an assigned factor, a surrogate was assigned based on chemical and structural similarity.

6.5.4 Risk Characterization

Overall, while there is some uncertainty associated with risk assessment, the calculated cancer risks and HIs are protective estimates, so that any actual risk, if it exists, will likely be lower than the estimates.

For noncancer hazard, acceptable lifetime exposure levels correspond to HIs equal to or less than 1. The individual HQs for each chemical should be added together only for chemicals that affect the same target organ. Therefore, adding all HQs for each chemical into a single HI value represents a protective estimate of the potential for noncancer health effects.

6.6 HHRA CONCLUSIONS

The cancer risks and noncancer hazard values without metals found at ambient levels are at or below levels of significance; i.e. a cancer risk of 1×10-6 and an HI of 1, respectively.

7. CONCLUSIONS AND RECOMMENDATIONS

For the soils samples, the VOCs, PCBs, and PNAs were all reported as nondetect, with the exception of a few very low "J" values reported. "J" values indicate that the gas chromatography/mass spectrometry (GCMS) picked something up but the results were so low compared to the detection limit that the laboratory could not quantify the concentration with any significant accuracy. In a few samples evidence of asphalt was noted. Specifically, samples DPT 5-8', DPT 6-1', DPT 6-5' and DPT 7-6'reported the presence of asphalt. However, only one of these samples (DPT 6-1') contained any reportable concentrations of polynuclear aromatic hydrocarbons (PNAs). This sample reported a very low concentration of chrysene (0.004 mg/kg). A couple of the samples did report measurable mercury but at very low values. The metal values reported were within normal background concentrations.

The groundwater samples reported nondetect for all organics and perchlorate[4] Selected metals are present in the HSA grab samples but this was expected as the samples were unfiltered. The sample were unfiltered because the principle concern with groundwater was impacted by VOCs and TLG did not wish to lose any organics that may have been attached to the particulates captured in the groundwater grab samples. The metal groundwater sample results from monitoring well GB-5 were used in the risk assessment that was performed. The soil gas results also were all ND, while the Summa™ canister results were very low (parts-per-trillion to low part-per- billion values).

Based on the soil gas, soil matrix and groundwater results, a human health risk assessment was conducted using a residential scenario. The results of the risk assessment show that no significant risk or health hazard is present at the site in its current condition.

[4] Groundwater sample

Based on the history of the site, the analytical results reported and the results of the risk assessment, TLG concludes that the site, in it current condition, does not pose a significant risk under a residential use scenario and that no further site characterization of any media is needed. Furthermore, no remediation of soil gas, soils or groundwater is needed and there is no environmental basis to preclude the site from being developed for residential use.

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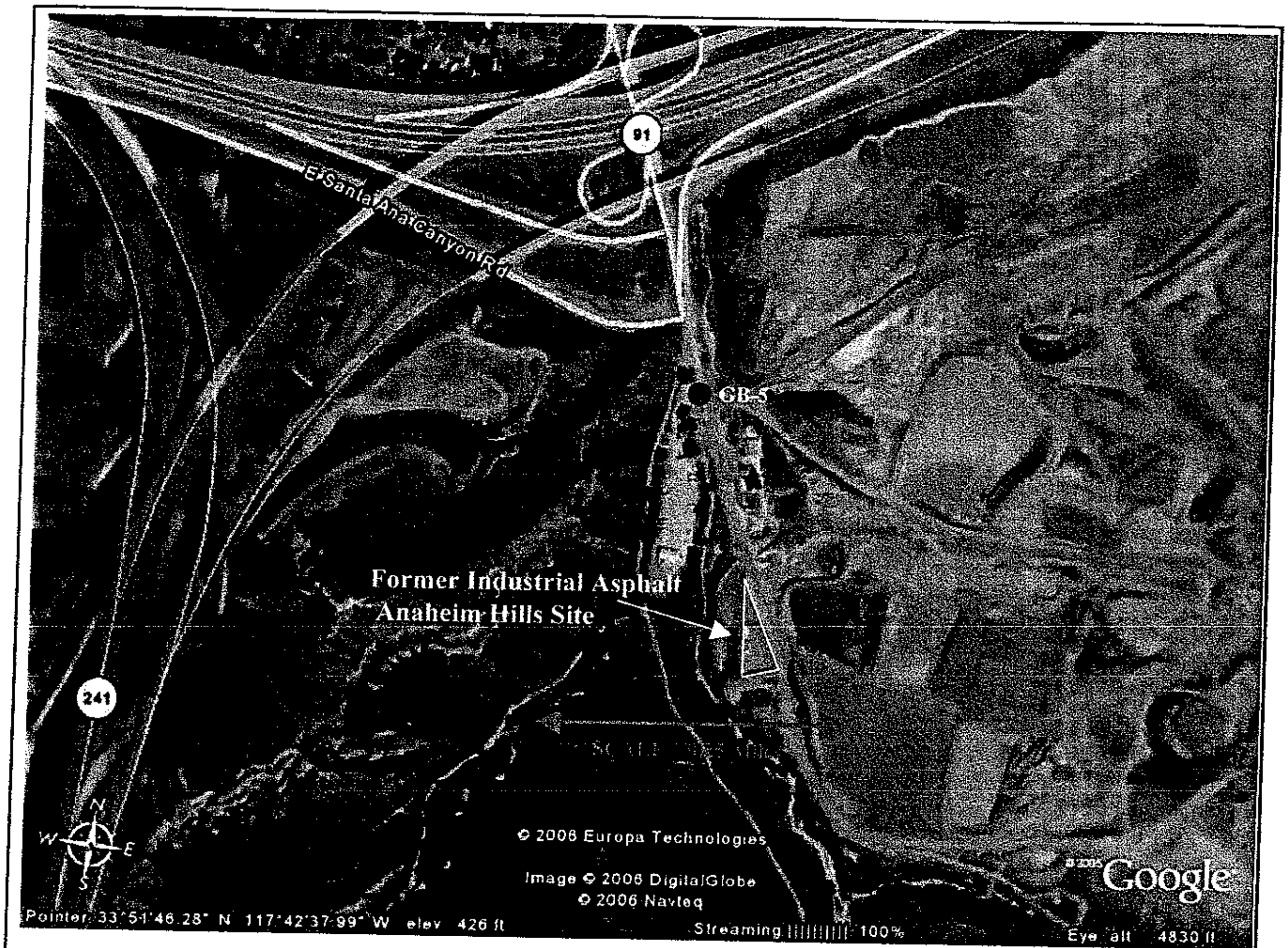
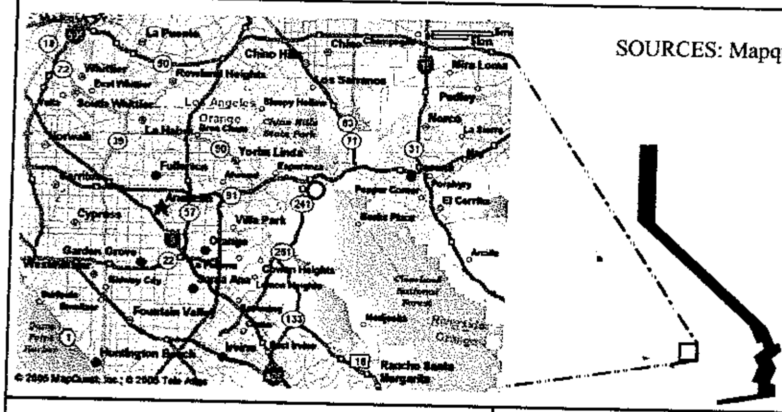
FIGURES



Notes: GB-5 is an existing groundwater monitoring well located to the north of the Industrial Asphalt site



SOURCES: Mapquest com and Google.com

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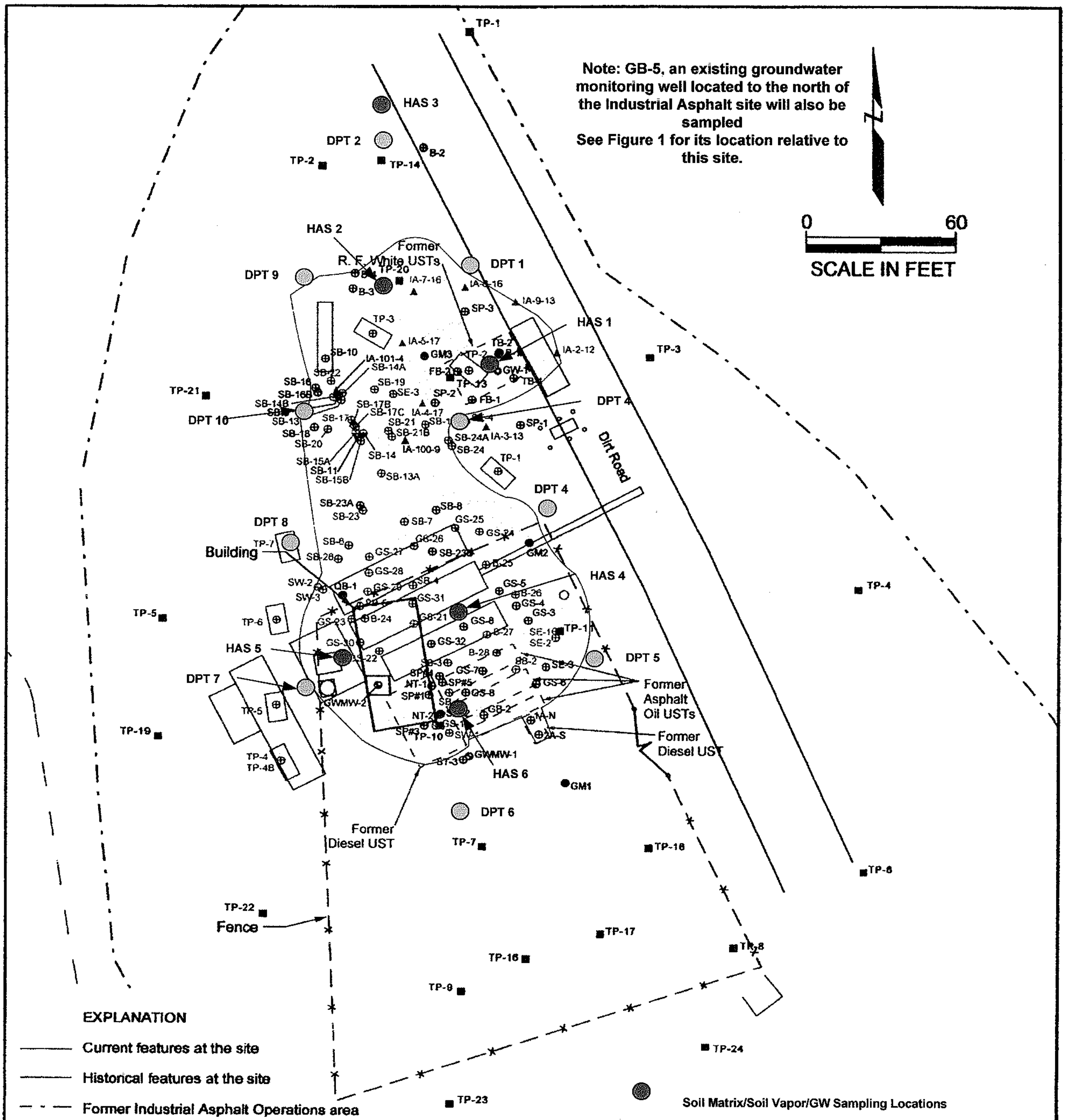
FAX: (949) 248-8785

SITE LOCATION MAP

Figure: 1-1

Former Industrial Asphalt Site
9010 East Santa Ana Canyon Road
Anaheim, California

Project: Vulcan Anaheim Hills



EXPLANATION

- Current features at the site
- Historical features at the site
- Former Industrial Asphalt Operations area
- Soil sample location converted to monitoring well (Geosec, 1991)
- Soil sample location in excavated area (Western Environmental Contracting, Inc., 1996)
- Soil sample location (State Environmental Management, Inc., 1994)
- Test pit location (State Environmental Management, Inc., 1994)
- Test pit location (Geomatrix, 2001)
- Soil sample location (GeoSyntec, 2003 and 2004)
- Soil Matrix/Soil Vapor/GW Sampling Locations
- Soil Vapor Sampling Locations
- Areas Excavated in 1991, 1994, and 1996

Notes:

1. All locations are approximate based on previous consultants' reports.
2. When soil sample location is shown in green, the sample location remained after excavation reported by Western Environmental Contracting, Inc. and State Environmental Management, Inc.

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SOIL, SOIL VAPOR & GROUNDWATER SAMPLING LOCATIONS

Former Industrial Asphalt Plant
Anaheim, California

FIGURE 3-1

MAP_4mv.pen

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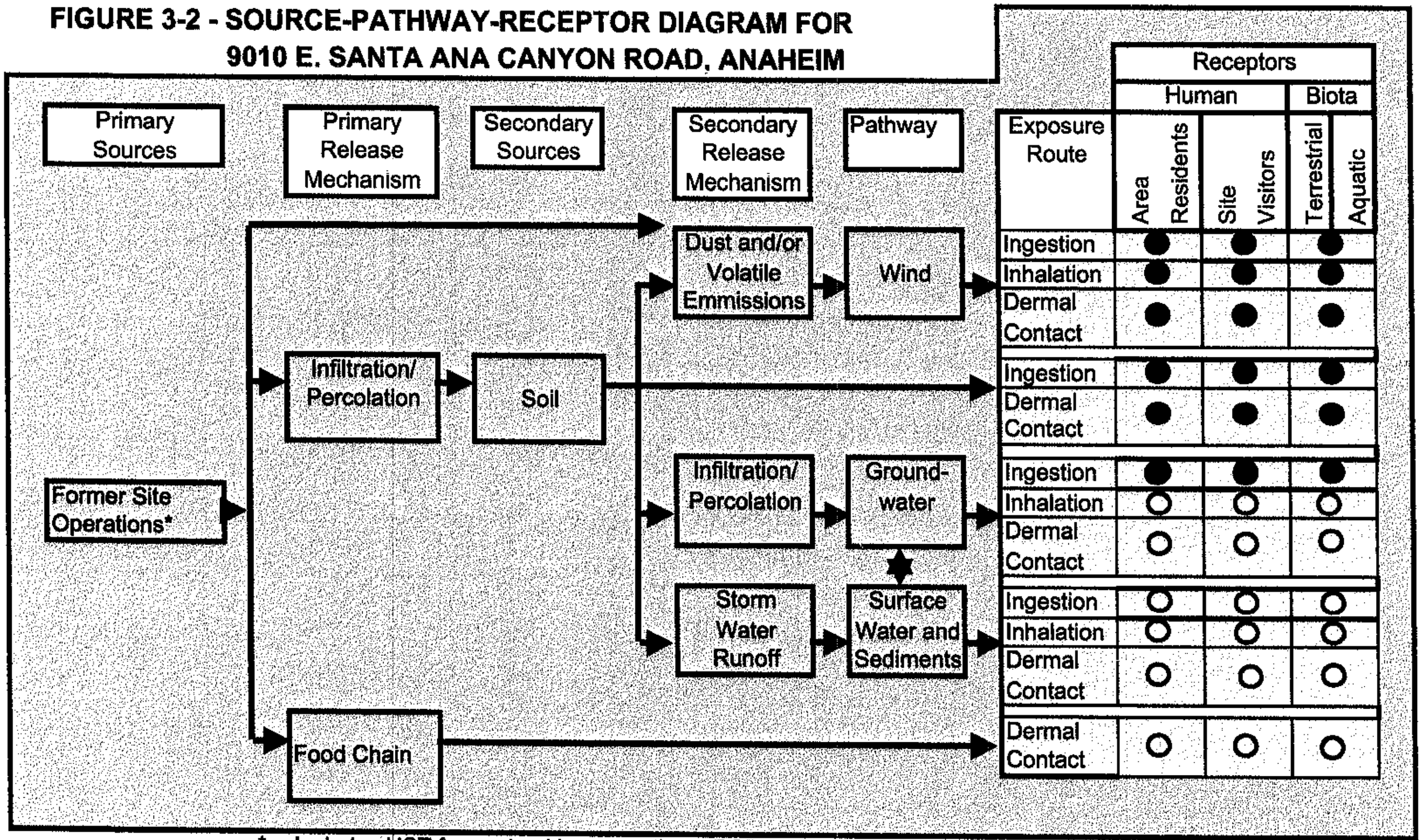
s:\7300s\7316\7316.000\05_0131_rtc_fig_06.dgn
\\OAKPRNT1\Splash_hold geomtrx.ctb

FIGURE 3-2 - SOURCE-PATHWAY-RECEPTOR DIAGRAM FOR 9010 E. SANTA ANA CANYON ROAD, ANAHEIM



* Includes UST farms, trucking operations, PCBs, metals, perchlorate, PAHs

● Pathway complete, further evaluation recommended.

○ Pathway evaluated and found to be incomplete, no further evaluation recommended.

TABLES

TABLE 3-1

Water Quality at the Santa Ana River Reach 2

Parameter	Santa Ana River below Prado Dam			Santa Ana River at Imperial Highway		
	#of samples	Mean	Range	#of samples	Mean	Range
TSS (mg/L)	6	61	7.5 -77	4	101	53 - 140
Turbidity (NTU) [1]	51	19	1 - 180	48	20	0.7 - 78
Nitrate (mg/L as N)	62	5.2	1.4 - 14	51	3.8	0.5 - 8.4
TKN (mg/L as N)	62	0.8	0.02 - 2.1	51	0.8	0.02 - 2.2
Orthophosphate[2] (mg/L as P)	56	0.8	0.3 -1.5	47	0.7	0.4 -1.7
Dissolved Copper (µg/L)	10	6.5	2-16	10	10.5	2.1-35
Total Copper (µg/L)	5	10.2	4.1 - 14	7	11.6	5-22
Total Lead (µg/L)	5	0.7	0.1-2	6	0.5	0.1-2.2
Total Zinc (µg/L)	5	10	5-19	6	18	5-70
Hardness (mg/L as $CaCO_3$)	56	240	81 - 281	46	266	193 - 515

1 Turbidity is measured as "nephelometric turbidity units", which is a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions.

2 Orthophosphate is the readily bioavailable portion of total phosphorous.

Source: GeoSyntec, 2005

TABLE 4-1

Depths of Soil Vapor Samples Collected

Boring	Depth 1	Depth 2	Depth 3	Depth 4
DPT-1	5	15		
DPT-2	5	15		
DPT-3	5	*		
DPT-4	**3***	15		
DPT-5	*	15		
DPT-6	5	15		
DPT-7	5	**8***		
DPT-8	5	15		
DPT-9	5	15		
DPT-10	5	15		
HAS-1		20	25	36
HAS-2		20	25	36
HAS-3	**10****	20	25	*
HAS-4	**10****	20	25	38
HAS-5		*	25	36
HAS-6		20	25	36

* Soil vapor was not present at target depth due to excessive moisture

** Collected from backfill material

TABLE 4-2

Chemicals Of Concern (COCs)
And Analytes To Be Reported
Former Industrial Asphalt
Anaheim, California

Chemical	Method	Detection Limit	COPC or TBR*
Benzene	TO-15	5 ug/m^3	COPC
Toluene	TO-15	5 ug/m^3	COPC
Ethyl Benzene	TO-15	5 ug/m^3	COPC
Xylenes	TO-15	5 ug/m^3	COPC
Isopropylbenzene	8260B	100 ug/m^3	COPC
n-Propylbenzene	8260B	100 ug/m^3	COPC
1,2,4-Trimethylbenzene	TO-15	5 ug/m^3	COPC
1,3,5-Trimethylbenzene	TO-15	5 ug/m^3	COPC
tert-Butylbenzene	8260B	100 ug/m^3	COPC
sec-Butylbenzene	8260B	100 ug/m^3	COPC
p-Isopropyltoluene	8260B	100 ug/m^3	COPC
Naphthalene	TO-15	5 ug/m^3	COPC
Hexane	TO-15	5 ug/m^3	TBR
Cyclohexane	TO-15	5 ug/m^3	TBR
Heptane	TO-15	5 ug/m^3	TBR
Ethanol	8260B	100 ug/m^3	TBR
Methyl *tertiary* butyl ether (MTBE)	8260B	100 ug/m^3	TBR
Ethyl *tertiary* butyl ether (ETBE)	8260B	100 ug/m^3	TBR
Di-isopropyl ether (DIPE)	8260B	100 ug/m^3	TBR
Tertiary amyl methyl ether (TAME)	8260B	100 ug/m^3	TBR
Tertiary butyl alcohol (TBA)	8260B	100 ug/m^3	TBR
oxygen	gas meter	0.10%	TBR
carbon dioxide	gas meter	1 ppmv	TBR
methane	gas meter	20 ppmv	TBR
hydrogen sulfide	gas meter	1 ppmv	TBR

* COPC = chemicals of potential concern
TBR = to be reported

TABLE 4-3

Sampling Locations, Analytes Of Concern, Detection Limits, And Rationale For Each Locations

What	Location	NO.	Depth	Sampling Frequency	Number ofl Samples	USEPA Method	Rationale for Drilling
soil borings	Former R.F. White USTs	3	approx 40'	every 5' bgs	33	1	Possible Source Area
soil borings	Former Industrial Asphalt USTs	3	approx 40'	every 5' bgs	33	1	Possible Source Area
step out borings	Former R.F. White USTs	4	approx 40'	every 5' bgs	44	1	determine extent of impact
step out borings	Former Industrial Asphalt USTs	4	approx 40'	every 5' bgs	44	1	determine extent of impact
groundwater	Former R.F. White USTs	3	approx 40'	TD*	3	1	Possible Source Area
groundwater	Former Industrial Asphalt USTs	3	approx 40'	TD	3	1	Possible Source Area
stepout GW	Former R.F. White USTs	4	approx 40'	TD	4	1	determine extent of impact
stepout GW	Former Industrial Asphalt USTs	4	approx 40'	TD	4	1	determine extent of impact
soil vapor	Former R.F. White USTs	3	approx 40'	5, 15, 25, 40' bgs	15	2	Possible Source Area
soil vapor	Former Industrial Asphalt USTs	3	approx 40'	5, 15, 25, 40, 55' bgs	15	2	Possible Source Area
stepout soil vapor	Former R.F. White USTs	4	approx 40'	5, 15, 25, 40, 55' bgs	15	2	determine extent of impact
stepout soil vapor	Former Industrial Asphalt USTs	4	approx 40'	5, 15, 25, 40, 55' bgs	15	2	determine extent of impact
soil vapor	Approx. 50-ft grid	10	15'	5- and 15'	20	2	determine extent of impact
borings	3 soil vapor locations	3	cored to 5' bgs	5' bgs^	3	3	input to vapor migration model
borings	4 soil vapor locations	4	10'	1-, 3-, & 10' bgs	12		near former transformers

EPA Method	Analytes	detection limits
1 8015M CCID	carbon chain lengths	
8260B	MTBE, BTEX, VOCs	
'8270	PAHs	
314.1	perchlorate	
	metals	
2 8260B	VOCs	100 µg/m^3
TO-15	VOCs	5 µg/m^3
	Methane	20 ppmv
	Fixed gases	1 ppmv
4 8082	PCBs	

Analyses
3 soil moisture
total porosity
bulk debsity
matrix grain size

*TD = total depth

Table 6-1
Chemicals of Potential Concern in Soil, Groundwater and Soil Gas

CAS Number	Chemical	Soil 0-10 feet bgs	Groundwater Grab Samples	Groundwater Monitoring Well Samples	Soil Gas
Metals					
7440-38-2	Arsenic	✔	✔	✔	
7440-39-3	Barium	✔	✔	✔	
7440-41-7	Beryllium	✔	✔		
7440-43-9	Cadmium	✔	✔		
7440-47-3	Chromium	✔	✔		
7440-48-4	Cobalt	✔	✔		
7440-50-8	Copper	✔	✔		
7439-92-1	Lead	✔	✔		
7439-98-7	Molybdenum	✔	✔		
7440-02-0	Nickel	✔	✔		
7782-49-2	Selenium	✔	✔	✔	
7440-22-4	Silver	✔	✔	✔	
7440-62-2	Vanadium	✔	✔		
7440-66-6	Zinc	✔	✔	✔	
18540-29-9	Hexavalent Chromium	✔			
7439-97-6	Mercury	✔	✔		
Semivolatile Organic Compounds					
218-01-9	Chrysene	✔			
Volatile Organic Compounds					
67-64-1	Acetone				✔
71-43-2	Benzene				✔
75-27-4	Bromodichloromethane				✔
78-93-3	2-Butanone (MEK)				✔
75-15-0	Carbon disulfide				✔
75-00-3	Chloroethane				✔
67-66-3	Chloroform				✔
74-87-3	Chloromethane				✔
124-48-1	Dibromochloromethane				✔
541-73-1	1,3-Dichlorobenzene				✔
106-46-7	1,4-Dichlorobenzene				✔
100-41-4	Ethylbenzene				✔
591-78-6	2-Hexanone				✔
108-10-1	4-Methyl-2-Pentanone				✔
91-20-3	Naphthalene				✔
100-42-5	Styrene				✔
127-18-4	Tetrachloroethene				✔
108-88-3	Toluene				✔
71-55-6	1,1,1-Trichloroethane				✔
79-01-6	Trichloroethene				✔
75-69-4	Trichlorofluoromethane				✔
76-13-1	Trichlorotrifluoroethane				✔
108-05-4	Vinyl Acetate				✔
106-42-3	m,p-Xylenes				✔
95-47-6	o-Xylene				✔

Acronyms/Abbreviations:
bgs – below ground surface
CAS – Chemical Abstract Service

Table 6-2
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Vadose Zone Soil (0–10 feet bgs)

Scenario Time Frame: Current/Future
Medium: Soil
Exposure Medium: Vadose Zone Soil (0–10 feet bgs)

Chemical	CAS Number	Minimum Concentration[a] (Qualifier)	Maximum Concentration[a] (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (Qualifier)	Screening Background Value[b]	COPC Flag (Y/N)	Selection or Deletion[c]
Metals											
Arsenic	7440-38-2	2.78	10.4	mg/Kg	DPT 8-10'	48/48	—	10.4	7.44	Y	FD
Barium	7440-39-3	18.5	745	mg/Kg	HSA1-1'	48/48	—	745	68.1	Y	FD
Beryllium	7440-41-7	0.236	1.43	mg/Kg	DPT 8-10'	48/48	—	1.43	1.05	Y	FD
Cadmium	7440-43-9	0.073	3.69	mg/Kg	HSA1-1'	48/48	—	3.69	0.35	Y	FD
Chromium	7440-47-3	3.06	60	mg/Kg	HSA1-1'	48/48	—	60	8.1	Y	FD
Cobalt	7440-48-4	2.09	9.82	mg/Kg	DPT 9-1'	48/48	—	9.82	7.31	Y	FD
Copper	7440-50-8	3.84	29.7	mg/Kg	HSA1-1'	48/48	—	29.7	15.7	Y	FD
Lead	7439-92-1	3.89	35.3	mg/Kg	DPT 6-1'	48/48	—	35.3	11.6	Y	FD
Molybdenum	7439-98-7	0.051	3.82	mg/Kg	DPT 6-1'	29/48	1.0	3.82	0.07	Y	FD
Nickel	7440-02-0	2.49	18.9	mg/Kg	HSA1-1'	48/48	—	18.9	8.27	Y	FD
Selenium	7782-49-2	0.717	6.47	mg/Kg	DPT 6-5'	36/48	1.0	6.47	0.716	Y	FD
Silver	7440-22-4	0.296	2.24	mg/Kg	HSA1-1'	3/48	0.5	2.24	—	Y	FD
Vanadium	7440-62-2	10.1	57.3	mg/Kg	DPT 4-5'	48/48	—	57.3	41.4	Y	FD
Zinc	7440-66-6	12.7	76	mg/Kg	DPT 6-1'	48/48	—	76	33.9	Y	FD
Hexavalent Chromium	18540-29-9	27	27	µg/Kg	HSA1-1'	1/1	—	27	—	Y	FD
Mercury	7439-97-6	0.02	0.43	mg/Kg	HSA5-5'	30/48	0.14	0.43	0.04	Y	FD
Semivolatile Organic Compounds											
Chrysene	218-01-9	0.004	0.004	mg/Kg	DPT 6-1'	1/48	0.05	0.004	—	Y	FD

Notes:
[a] minimum and maximum detected concentrations
[b] maximum detected concentration
[c] rationale codes:
selection reason: frequency of detection (FD)

Acronyms/Abbreviations:
bgs – below ground surface
CAS – Chemical Abstract Service
COPC – chemical of potential concern
FD – frequency of detection
mg/kg – milligrams per kilogram
µg/kg – micrograms per kilogram
(Y/N) – yes/no

Table 6-3
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Groundwater (grab samples)

Scenario Time Frame: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Chemical	CAS Number	Minimum Concentration[a] (Qualifier)	Maximum Concentration[a] (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (Qualifier)	Screening Background Value	COPC Flag (Y/N)	Selection or Deletion[b]
Metals											
Arsenic	7440-38-2	0.207	1.37	mg/L	HSA2	6/6	—	1.37	—	Y	FD
Barium	7440-39-3	3.65	43.3	mg/L	HSA1	6/6	—	43.3	—	Y	FD
Beryllium	7440-41-7	0.023	0.13	mg/L	HSA2	5/6	0.05	0.13	—	Y	FD
Cadmium	7440-43-9	0.007	0.008	mg/L	HSA3	2/6	0.05	0.008	—	Y	FD
Chromium	7440-47-3	0.655	3.71	mg/L	HSA2	6/6	—	3.71	—	Y	FD
Cobalt	7440-48-4	0.173	0.99	mg/L	HSA2	6/6	—	0.99	—	Y	FD
Copper	7440-50-8	0.324	1.91	mg/L	HSA2	6/6	—	1.91	—	Y	FD
Lead	7439-92-1	0.219	1.34	mg/L	HSA2	6/6	—	1.34	—	Y	FD
Molybdenum	7439-98-7	0.043	0.4	mg/L	HSA4	5/6	0.1	0.4	—	Y	FD
Nickel	7440-02-0	0.331	1.88	mg/L	HSA2	6/6	—	1.88	—	Y	FD
Selenium	7782-49-2	0.094	0.094	mg/L	HSA5	1/6	0.01-0.1	0.094	—	Y	FD
Silver	7440-22-4	0.024	0.17	mg/L	HSA2	3/6	0.005-0.05	0.17	—	Y	FD
Vanadium	7440-62-2	0.805	4.7	mg/L	HSA2	6/6	—	4.7	—	Y	FD
Zinc	7440-66-6	0.955	6.4	mg/L	HSA2	6/6	—	6.4	—	Y	FD
Mercury	7439-97-6	0.029	0.029	mg/L	HSA3	1/6	0.004	0.029	—	Y	FD

Notes:
[a] minimum and maximum detected concentrations
[b] selection reason: frequency of detection (FD)

Acronyms/Abbreviations:
CAS – Chemical Abstract Service
COPC – chemical of potential concern
FD – frequency of detection
mg/L – milligrams per liter
(Y/N) – yes/no

Table 6-4
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Groundwater (monitoring well sample)

Scenario Time Frame: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Chemical	CAS Number	Minimum Concentration[a] (Qualifier)	Maximum Concentration[a] (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (Qualifier)	Screening Background Value	COPC Flag (Y/N)	Selection or Deletion[b]
Metals											
Arsenic	7440-38-2	0.017	0.017	mg/L	GB-5	1/1	—	0.017	—	Y	FD
Barium	7440-39-3	0.054	0.054	mg/L	GB-5	1/1	—	0.054	—	Y	FD
Selenium	7782-49-2	0.038	0.038	mg/L	GB-5	1/1	—	0.038	—	Y	FD
Silver	7440-22-4	0.005	0.005	mg/L	GB-5	1/1	—	0.005	—	Y	FD
Zinc	7440-66-6	0.047	0.047	mg/L	GB-5	1/1	—	0.047	—	Y	FD

Notes:
[a] minimum and maximum detected concentrations based on the sample except for silver which was only detected in the duplicate
[b] selection reason: frequency of detection (FD)

Acronyms/Abbreviations:
CAS – Chemical Abstract Service
COPC – chemical of potential concern
FD – frequency of detection
mg/L – milligrams per liter
(Y/N) – yes/no

Table 6-5
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Soil Gas

Scenario Time Frame: Current/Future
Medium: Soil Gas
Exposure Medium: Soil Gas

Chemical	CAS Number	Minimum Concentration[a] (Qualifier)	Maximum Concentration[a] (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (Qualifier)	Screening Background Value	COPC Flag (Y/N)	Selection or Deletion[b]
Volatile Organic Compounds											
Acetone	67-64-1	110	790	µg/m³	DPT10-15	10/10	—	790	—	Y	FD
Benzene	71-43-2	2.9	57	µg/m³	DPT10-15	10/10	—	57	—	Y	FD
Bromodichloromethane	75-27-4	2.2	7.8	µg/m³	HSA1-25	4/10	1.3-14	7.8	—	Y	FD
2-Butanone (MEK)	78-93-3	15	260	µg/m³	HSA1-25	10/10	—	260	—	Y	FD
Carbon disulfide	75-15-0	5.9	430	µg/m³	DPT10-15	10/10	—	430	—	Y	FD
Chloroethane	75-00-3	2.2	3.4	µg/m³	HSA5-20	2/10	1.3-14	3.4	—	Y	FD
Chloroform	67-66-3	2.5	15	µg/m³	HSA1-25	4/10	1.3-14	15	—	Y	FD
Chloromethane	74-87-3	1.5	1.7	µg/m³	HSA1-25	3/10	1.3-14	1.7	—	Y	FD
Dibromochloromethane	124-48-1	1.5	6.2	µg/m³	HSA1-25	3/10	1.3-14	6.2	—	Y	FD
1,3-Dichlorobenzene	541-73-1	1.7	1.9	µg/m³	HSA1-36	2/10	1.3-14	1.9	—	Y	FD
1,4-Dichlorobenzene	106-46-7	4.4	5.3	µg/m³	HSA3-10	3/10	1.4-14	5.3	—	Y	FD
Ethylbenzene	100-41-4	2.1	6.8	µg/m³	DPT10-5	9/10	14	6.8	—	Y	FD
2-Hexanone	591-78-6	2.3	13	µg/m³	DPT10-5	9/10	14	13	—	Y	FD
4-Methyl-2-Pentanone	108-10-1	1.4	30	µg/m³	DPT10-5	8/10	1.4-14	30	—	Y	FD
Naphthalene	91-20-3	1.5	4.8	µg/m³	HSA3-10	6/10	1.4-14	4.8	—	Y	FD
Styrene	100-42-5	1.8	8.9	µg/m³	HSA3-20	8/10	1.5-14	8.9	—	Y	FD
Tetrachloroethene	127-18-4	1.8	2.4	µg/m³	HSA5-25	3/10	1.3-14	2.4	—	Y	FD
Toluene	108-88-3	8	34	µg/m³	DPT10-5	10/10	—	34	—	Y	FD
1,1,1-Trichloroethane	71-55-6	28	36	µg/m³	HSA5-25	2/10	1.3-14	36	—	Y	FD
Trichloroethene	79-01-6	1.5	8.9	µg/m³	HSA3-25	4/10	1.4-14	8.9	—	Y	FD
Trichlorofluoromethane	75-69-4	1.8	2.3	µg/m³	HSA1-20	3/10	1.3-14	2.3	—	Y	FD
Trichlorotrifluoroethane	76-13-1	5.6	6.3	µg/m³	HSA5-25	2/10	1.3-14	6.3	—	Y	FD
Vinyl Acetate	108-05-4	3.3	84	µg/m³	DPT10-15	10/10	—	84	—	Y	FD
m,p-Xylenes	106-42-3	7.7	22	µg/m³	DPT10-5 and 15	10/10	—	22	—	Y	FD
o-Xylene	95-47-6	2.8	10	µg/m³	DPT10-5	9/10	14	10	—	Y	FD

Notes:
[a] minimum and maximum detected concentrations
[b] selection reason: frequency of detection (FD)

Acronyms/Abbreviations:
CAS – Chemical Abstract Service
COPC – chemical of potential concern
FD – frequency of detection
µg/m³ – micrograms per cubic meter
(Y/N) – yes/no

Table 6-6
Exposure Point Concentration Summary
Vadose Zone Soil (0–10 feet bgs)

Scenario Time Frame: Current/Future
Medium: Soil
Exposure Medium: Vadose Zone Soil (0–10 feet bgs)

Chemical	Units	Arithmetic Mean	95% UCL	Maximum Concentration	EXPOSURE POINT CONCENTRATION		
					Value*	Statistic	Rationale
Metals							
Arsenic	mg/Kg	6.21	6.80	10.4	6.80	Assuming gamma distribution (0.05)	U.S. EPA guidance
Barium	mg/Kg	65.53	130.14	745	130.14	Data are Non-parametric (0.05)	U.S. EPA guidance
Beryllium	mg/Kg	0.67	0.91	1.43	0.91	Data are Non-parametric (0.05)	U.S. EPA guidance
Cadmium	mg/Kg	0.37	0.70	3.69	0.70	Data are Non-parametric (0.05)	U.S. EPA guidance
Chromium	mg/Kg	8.35	13.55	60	13.55	Data are Non-parametric (0.05)	U.S. EPA guidance
Cobalt	mg/Kg	5.29	6.68	9.82	6.68	Data are Non-parametric (0.05)	U.S. EPA guidance
Copper	mg/Kg	10.87	15.03	29.7	15.03	Data are Non-parametric (0.05)	U.S. EPA guidance
Lead	mg/Kg	9.72	11.02	35.3	11.02	Assuming gamma distribution (0.05)	U.S. EPA guidance
Molybdenum	mg/Kg	0.48	0.88	3.82	0.88	Data are Non-parametric (0.05)	U.S. EPA guidance
Nickel	mg/Kg	7.39	8.42	18.9	8.42	Data are lognormal (0.05)	U.S. EPA guidance
Selenium	mg/Kg	1.91	2.84	6.47	2.84	Data are Non-parametric (0.05)	U.S. EPA guidance
Silver	mg/Kg	0.32	0.54	2.24	0.54	Data are Non-parametric (0.05)	U.S. EPA guidance
Vanadium	mg/Kg	28.83	37.74	57.3	37.74	Data are Non-parametric (0.05)	U.S. EPA guidance
Zinc	mg/Kg	31.28	34.76	76	34.76	Data follow gamma distribution (0.05)	U.S. EPA guidance
Hexavalent Chromium	µg/Kg	—	—	27	27	Maximum	U.S. EPA guidance
Mercury	mg/Kg	0.057	0.093	0.43	0.093	Data are Non-parametric (0.05)	U.S. EPA guidance
Semivolatile Organic Compounds							
Chrysene	mg/Kg	0.025	0.026	0.004	0.004	Data are Non-parametric (0.05)	U.S. EPA guidance

Note:
* the maximum positive detection was used as the exposure point concentration when the 95% UCL exceeded the maximum positive detection

Acronyms/Abbreviations:
bgs – below ground surface
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
UCL – upper confidence limit
U.S. EPA – United States Environmental Protection Agency

Table 6-7
Exposure Point Concentration Summary
Groundwater (grab samples)

Scenario Time Frame: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

					EXPOSURE POINT CONCENTRATION		
Chemical	**Units**	**Arithmetic Mean**	**95% UCL**	**Maximum Concentration**	**Value***	**Statistic**	**Rationale**
Metals							
Arsenic	mg/L	0.68	1.01	1.37	1.01	Data are normal (0.05)	U.S. EPA guidance
Barium	mg/L	21.6	34.2	43.3	34.2	Data are normal (0.05)	U.S. EPA guidance
Beryllium	mg/L	0.06	0.10	0.13	0.10	Data are normal (0.05)	U.S. EPA guidance
Cadmium	mg/L	0.019	0.035	0.008	0.008	Maximum	U.S. EPA guidance
Chromium	mg/L	2.27	3.34	3.71	3.34	Data are normal (0.05)	U.S. EPA guidance
Cobalt	mg/L	0.52	0.75	0.99	0.75	Data are normal (0.05)	U.S. EPA guidance
Copper	mg/L	1.07	1.53	1.91	1.53	Data are normal (0.05)	U.S. EPA guidance
Lead	mg/L	0.68	1.01	1.34	1.01	Data are normal (0.05)	U.S. EPA guidance
Molybdenum	mg/L	0.19	0.30	0.4	0.30	Data are normal (0.05)	U.S. EPA guidance
Nickel	mg/L	1.19	1.71	1.88	1.71	Data are normal (0.05)	U.S. EPA guidance
Selenium	mg/L	0.050	0.073	0.094	0.073	Data are normal (0.05)	U.S. EPA guidance
Silver	mg/L	0.055	0.11	0.17	0.11	Data are normal (0.05)	U.S. EPA guidance
Vanadium	mg/L	2.31	3.46	4.7	3.46	Data are normal (0.05)	U.S. EPA guidance
Zinc	mg/L	3.29	4.80	6.4	4.80	Data are normal (0.05)	U.S. EPA guidance
Mercury	mg/L	0.0065	0.026	0.029	0.026	Data are Non-parametric (0.05)	U.S. EPA guidance

Note:
* the maximum positive detection was used as the exposure point concentration when the 95% UCL exceeded the maximum positive detection

Acronyms/Abbreviations:
mg/L – milligrams per liter
UCL – upper confidence limit
U.S. EPA – United States Environmental Protection Agency

Table 6-8
Reasonable Maximum Exposure Values Used for Daily Intake

Equation Parameter		Units	Residential Child[a]		Residential Adult[b]		Intake Equation
Ingestion of Soil							
Concentration in soil	C_S	mg/kg	Chemical specific		Chemical specific		$(C_S$ x CF x IRS x EF x ED) / (BW x AT)
Conversion factor	CF	kg/mg	1.00E-06	U.S. EPA 2004a	1.00E-06	U.S. EPA 2004a	
Intake rate	IRS	mg/day	200	U.S. EPA 2004a	100	U.S. EPA 2004a	
Exposure frequency	EF	days/year	350	U.S. EPA 2004a	350	U.S. EPA 2004a	
Exposure duration	ED	years	6	U.S. EPA 2004a	24	U.S. EPA 2004a	
Body weight	BW	kg	15	U.S. EPA 2004a	70	U.S. EPA 2004a	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004a	25,550	U.S. EPA 2004a	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004a	8,760	U.S. EPA 2004a	
Dermal Contact with Soil							
Concentration in soil	C_S	mg/kg	Chemical specific		Chemical specific		$(C_S$ x CF x AF x SA x DAF x EF x ED) / (BW x AT)
Conversion factor	CF	kg/mg	1.00E-06	U.S. EPA 2004a	1.00E-06	U.S. EPA 2004a	
Adherence factor	AF	mg/cm²	0.2	U.S. EPA 2004a U.S. EPA 2004b	0.07	U.S. EPA 2004a U.S. EPA 2004b	
Exposed skin area	SA	cm²/day	2,800	U.S. EPA 2004a U.S. EPA 2004b	5,700	U.S. EPA 2004a U.S. EPA 2004b	
Dermal absorption factor	DAF	unitless	Chemical specific	DTSC 1994 U.S. EPA 2004a	Chemical specific	DTSC 1994 U.S. EPA 2004a	
Exposure frequency	EF	days/year	350	U.S. EPA 2004a	350	U.S. EPA 2004a	
Exposure duration	ED	years	6	U.S. EPA 2004a	24	U.S. EPA 2004a	
Body weight	BW	kg	15	U.S. EPA 2004a	70	U.S. EPA 2004a	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004a	25,550	U.S. EPA 2004a	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004a	8,760	U.S. EPA 2004a	
Inhalation of Soil Particulates in Outdoor Air							
Concentration in soil	C_S	mg/kg	Chemical specific		Chemical specific		$(C_S$ x IRA x ET x EF x ED) / (PEF x BW x AT)
Intake rate	IRA	m³/hour	0.42	U.S. EPA 2004a	0.83	U.S. EPA 2004a	
Particulate emission factor	PEF	m³/kg	1.316E+09	U.S. EPA 2004a	1.316E+09	U.S. EPA 2004a	
Exposure time	ET	hours/day	24		24		
Exposure frequency	EF	days/year	350	U.S. EPA 2004a	350	U.S. EPA 2004a	
Exposure duration	ED	years	6	U.S. EPA 2004a	24	U.S. EPA 2004a	
Body weight	BW	kg	15	U.S. EPA 2004a	70	U.S. EPA 2004a	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004a	25,550	U.S. EPA 2004a	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004a	8,760	U.S. EPA 2004a	

Table 6-8
Reasonable Maximum Exposure Values Used for Daily Intake

Equation Parameter		Units	Residential Child[a]		Residential Adult[b]		Intake Equation
Ingestion of Groundwater							
Concentration in groundwate	C_{GW}	mg/L	Chemical specific		Chemical specific		$(C_{GW} \times IRS \times EF \times ED) / (BW \times AT)$
Intake rate	IRS	L/day	1	U.S. EPA 2004a	2	U.S. EPA 2004a	
Exposure frequency	EF	days/year	350	U.S. EPA 2004a	350	U.S. EPA 2004a	
Exposure duration	ED	years	6	U.S. EPA 2004a	24	U.S. EPA 2004a	
Body weight	BW	kg	15	U.S. EPA 2004a	70	U.S. EPA 2004a	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004a	25,550	U.S. EPA 2004a	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004a	8,760	U.S. EPA 2004a	
Inhalation of Vapors in Indoor Air Originating from Soil Gas							
Concentration in indoor air based on concentration in soil and groundwater	C_A	mg/m³	Chemical specific	U.S. EPA 2004c	Chemical specific	U.S. EPA 2004c	$(C_A \times IRA \times ET \times EF \times ED) / (BW \times AT)$
Intake rate	IRA	m³/hour	0.42	U.S. EPA 2004a	0.83	U.S. EPA 2004a	
Exposure time	ET	hours/day	24		24		
Exposure frequency	EF	days/year	350	U.S. EPA 2004a	350	U.S. EPA 2004a	
Exposure duration	ED	years	6	U.S. EPA 2004a	24	U.S. EPA 2004a	
Body weight	BW	kg	15	U.S. EPA 2004a	70	U.S. EPA 2004a	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004a	25,550	U.S. EPA 2004a	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004a	8,760	U.S. EPA 2004a	

Notes:
[a] residential child age is 0 to 6 years
[b] residential carcinogenic exposure was assumed for a total of 30 years; 6 years as a child and 24 years as an adult; residential noncarcinogenic exposure was assumed for a total of 6 years as a child

Acronyms/Abbreviations:
cm²/day – square centimeters per day
days/year – days per year
DTSC – Department of Toxic Substances Control
hours/day – hours per day
kg – kilograms
kg/mg – kilograms per milligram
L/day – liters per day
m³/hour – cubic meters per hour
m³/kg – cubic meters per kilogram
mg/cm² – milligrams per square centimeter
mg/day – milligrams per day
mg/kg – milligrams per kilogram
mg/L – milligrams per liter
mg/m³ – milligrams per cubic meter
U.S. EPA – United States Environmental Protection Agency

Table 6-8
Reasonable Maximum Exposure Values Used for Daily Intake

Equation Parameter	Units	Residential Child[a]	Residential Adult[b]	Intake Equation

References:

DTSC 1994. Preliminary Endangerment Assessment Guidance Manual. January.

U.S. EPA 2004a. Region 9 Preliminary Remediation Goals. October.

U.S. EPA 2004b. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005. September.

U.S. EPA 2004c. Software Implementation of Johnson and Ettinger Model. Version 3.0. February.

Table 6-9
Chemical-Specific Values Used to Evaluate the Dermal Contact with Soil Exposure Pathway

CAS Number	Chemical	ABSORPTION FACTORS FOR SOIL DTSC	U.S. EPA	Most Conservative
Metals				
7440-38-2	Arsenic	0.03	0.03	0.03
7440-39-3	Barium	0.01	—	0.01
7440-41-7	Beryllium	0.01	—	0.01
7440-43-9	Cadmium	0.001	0.001	0.001
7440-47-3	Chromium	0.01	—	0.01
7440-48-4	Cobalt	0.01	—	0.01
7440-50-8	Copper	0.01	—	0.01
7439-92-1	Lead	0.01	—	0.01
7439-98-7	Molybdenum	0.01	—	0.01
7440-02-0	Nickel	0.01	—	0.01
7782-49-2	Selenium	0.01	—	0.01
7440-22-4	Silver	0.01	—	0.01
7440-62-2	Vanadium	0.01	—	0.01
7440-66-6	Zinc	0.01	—	0.01
18540-29-9	Hexavalent Chromium*	0	—	0
7439-97-6	Mercury	0.01	—	0.01
Semivolatile Organic Compounds				
218-01-9	Chrysene	0.15	0.13	0.15

Note:
* not considered for the dermal pathway

Acronyms/Abbreviations:
CAS – Chemical Abstract Services
DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
U.S. EPA – United States Environmental Protection Agency

References:
DTSC 1994. Preliminary Endangerment Assessment Guidance Manual. January.
U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.

Table 6-10
Toxicity Values[a]

CAS Number	Chemical	Cancer Class	Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
Metals										
7440-38-2	Arsenic	A	9.45E+00	C	1.20E+01	C	3.00E-04	I	—	
7440-39-3	Barium	D	—		—		2.00E-01	I	1.40E-04	H
7440-41-7	Beryllium	B1	—		8.40E+00	C	2.00E-03	I	5.71E-06	I
7440-43-9	Cadmium	B1	3.80E-01	C	1.50E+01	C	5.00E-04	I	—	
7440-47-3	Chromium[b]	A	—		7.40E+01	C	3.00E-03	S	2.29E-06	S
7440-48-4	Cobalt	Not in IRIS	—		9.80E+00	P	2.00E-02	P	5.70E-06	P
7440-50-8	Copper	D	—		—		4.00E-02	H	—	
7439-92-1	Lead	B2	—		—		—		—	
7439-98-7	Molybdenum	NA	—		—		5.00E-03	I	—	
7440-02-0	Nickel	A	—		9.10E-01	C	2.00E-02	I	—	
7782-49-2	Selenium	D	—		—		5.00E-03	I	—	
7440-22-4	Silver	D	—		—		5.00E-03	I	—	
7440-62-2	Vanadium	Not in IRIS	—		—		1.00E-03	N	—	
7440-66-6	Zinc	D	—		—		3.00E-01	I	—	
18540-29-9	Hexavalent Chromium	A	—		5.10E+02	C	3.00E-03	I	2.29E-06	I
7439-97-6	Mercury	C	—		—		3.00E-04	I	—	
Semivolatile Organic Compounds										
218-01-9	Chrysene	B2	1.20E-01	C	3.90E-02	C	3.00E-01	S	3.00E-01	S
Volatile Organic Compounds										
67-64-1	Acetone	NP	—		—		9.00E-01	I	9.00E-01	R
71-43-2	Benzene	A	1.00E-01	C	1.00E-01	C	4.00E-03	I	8.57E-03	I
75-27-4	Bromodichloromethane	B2	1.30E-01	C	1.30E-01	C	2.00E-02	I	2.00E-02	R
78-93-3	2-Butanone (MEK)	NP	—		—		6.00E-01	I	1.43E+00	I
75-15-0	Carbon Disulfide	NA	—		—		1.00E-01	I	2.00E-01	I
75-00-3	Chloroethane	NA	2.90E-03	N	2.90E-03	R	4.00E-01	N	2.86E+00	I
67-66-3	Chloroform	B2	3.10E-02	C	1.90E-02	C	1.00E-02	I	1.40E-02	N
74-87-3	Chloromethane	D	—		—		2.57E-02	R	2.57E-02	I
124-48-1	Dibromochloromethane	C	9.40E-02	C	9.40E-02	C	2.00E-02	I	2.00E-02	R
541-73-1	1,3-Dichlorobenzene	D	—		—		3.00E-02	N	3.00E-02	R
106-46-7	1,4-Dichlorobenzene	NA	5.40E-03	C	4.00E-02	C	3.00E-02	N	2.29E-01	I
100-41-4	Ethylbenzene	D	—		—		1.00E-01	I	2.86E-01	I

Table 6-10
Toxicity Values[a]

CAS Number	Chemical	Cancer Class	Cal/EPA CSFo (mg/kg-day)$^{-1}$		Cal/EPA CSFi (mg/kg-day)$^{-1}$		U.S. EPA RfDo (mg/kg-day)		U.S. EPA RfDi (mg/kg-day)	
591-78-6	2-Hexanone	Not in IRIS	—		—		1.10E+01	S	5.71E-02	S
108-10-1	4-Methyl-2-Pentanone	NP	—		—		8.00E-02	H	8.57E-01	I
91-20-3	Naphthalene	C	—		1.20E-01	C	2.00E-02	I	8.57E-04	I
100-42-5	Styrene	NA	—		—		2.00E-01	I	2.86E-01	I
127-18-4	Tetrachloroethene	NA	5.40E-01	C	2.10E-02	C	1.00E-02	I	1.00E-02	C
108-88-3	Toluene	NP	—		—		8.00E-02	I	1.43E+00	I
71-55-6	1,1,1-Trichloroethane	D	—		—		2.80E-01	N	6.30E-01	P
79-01-6	Trichloroethene	NA	1.30E-02	C	7.00E-03	C	3.00E-04	N	1.00E-02	N
75-69-4	Trichlorofluoromethane	NA	—		—		3.00E-01	I	2.00E-01	H
76-13-1	Trichlorotrifluoroethane	NA	—		—		3.00E+01	I	8.60E+00	H
108-05-4	Vinyl Acetate	NA	—		—		1.00E+00	H	5.70E-02	I
7816-60-0	m,p-Xylene	Not in IRIS	—		—		2.00E-01	S	2.86E-02	S
95-47-6	o-Xylene	Not in IRIS	—		—		2.00E-01	S	2.86E-02	S

Note:
[a] a dash indicates that a toxicity value is not available
[b] the Cal/EPA inhalation slope factor for total chromium was calculated per U.S. EPA guidance

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
CAS – chemical abstract services number
CSFi – inhalation cancer slope factor
CSFo – oral cancer slope factor
HEAST – Health Effects Assessment Summary Table
IRIS – Integrated Risk Information System

Table 6-10
Toxicity Values[a]

CAS Number	Chemical	Cancer Class	Cal/EPA CSFo $(mg/kg\text{-}day)^{-1}$	Cal/EPA CSFi $(mg/kg\text{-}day)^{-1}$	U.S. EPA RfDo (mg/kg-day)	U.S. EPA RfDi (mg/kg-day)

Reference:

C – California website source, http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H – HEAST as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.
I – IRIS, http://www.epa.gov/iris/subst/index.html
N – NCEA as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.
P – PPRTV as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.
R – route-to-route extrapolation as listed in U.S. EPA 2004. Region 9 Preliminary Remediation Goals. October.
S – values based on a surrogate chemical

Cancer class:

A – human carcinogen
B1 – probable human carcinogen with limited human data
B2 – probable human carcinogen with sufficient evidence in animals and inadequate or no evidence in humans
C – possible human carcinogen
D – not classifiable as to human carcinogenicity
NA – not assessed
NP – not applicable (not assessed using the 1986 U.S. EPA cancer guidelines)

Table 6-11
Surrogate Chemicals for COPCs Without Toxicity Criteria

COPC	CSF Surrogate	CSF Surrogate Basis	RfD Surrogate	RfD Surrogate Basis
Metals				
Chromium	NA	NA	hexavalent chromium	Chemical similarity
Semivolatile Organic Compounds				
Chrysene	NA	NA	anthracene	Chemical similarity
Volatile Organic Compounds				
2-Hexanone	NA	NA	n-hexane	Chemical similarity
m-, p-Xylene	NA	NA	xylenes	Chemical similarity
o-Xylene	NA	NA	xylenes	Chemical similarity

Acronyms/Abbreviations:
COPC – chemical of potential concern
CSF – cancer slope factor
NA – not applicable
RfD – reference dose

Table 6-12
Human Health Risk Assessment by Exposure Pathway

Exposure Pathway	Cancer Risk	Hazard Index
Ingestion of soil	1E-04	9E-01
Dermal contact with soil	1E-05	3E-02
Inhalation of vapors in indoor air from soil gas	1E-07	2E-03
Inhalation of particulates	1E-07	4E-03
Ingestion of Groundwater (monitoring well sample)	3E-03	5E+00
Total	**3E-03**	**6E+00**
Total without Arsenic in Soil and Groundwater	**6E-07**	**1E+00**

For Comparison Purposes		
Ingestion of Groundwater (grab samples)	1E-01	5E+02

Table 6-13
Summary of Cancer Risk Drivers for COPCs - Reasonable Maximum Exposure
Cal/EPA (Residential)

Scenario Time Frame: Future
Exposure Point: Vulcan
Receptor Population: Residential
Receptor Age: Child/Adult

Exposure Medium	Chemical	EPC: Direct Contact[a]	EPC: Indoor Vapor[b]	CANCER RISK: Ingestion	CANCER RISK: Dermal Contact	CANCER RISK: Inhalation of Dust	CANCER RISK: Inhalation of Indoor Air	Exposure Route Total
0–10 feet bgs Soil	**Metals**							
	Arsenic	6.80E+00	—	1E-04	1E-05	9E-09		1E-04
Total Risk Drivers Across Soil				**1E-04**	**1E-05**	**9E-09**		**1E-04**
Groundwater	**Metals**							
	Arsenic	1.70E-02	—	3E-03				3E-03
Total Risk Drivers Across Groundwater				**3E-03**				**3E-03**
Total Risk Drivers Across Soil Gas								**0E+00**
Total Risk Drivers Across All Media and All Exposure Routes				**3E-03**	**1E-05**	**9E-09**	**0E+00**	**3E-03**
Total Sitewide Risk Across All Media and All Exposure Routes				**3E-03**	**1E-05**	**1E-07**	**1E-07**	**3E-03**

Notes:

[a] Units for soil concentrations are milligrams per kilogram (mg/kg), units for groundwater concentrations are milligrams per liter (mg/L) and units for soil gas are micrograms per cubic meter (μg/m³)
[b] Units for vapor phase are milligrams per cubic meter (mg/m³)

Acronyms/Abbreviations:
bgs – below ground surface
Cal/EPA – California Environmental Protection Agency
COPC – chemical of potential concern
EPC – exposure point concentration

Table 6-14
Summary of Hazard Risk Drivers for COPCs - Reasonable Maximum Exposure
U.S. EPA (Residential)

Scenario Time Frame: Future
Exposure Point: Vulcan
Receptor Population: Residential
Receptor Age: Child

Exposure Medium	Chemical	EPC: Direct Contact[a]	EPC: Indoor Vapor[b]	HAZARD INDEX: Ingestion	HAZARD INDEX: Dermal Contact	HAZARD INDEX: Inhalation of Dust	HAZARD INDEX: Inhalation of Indoor Air	Exposure Route Total
0–10 feet bgs Soil	**Metals**							
	Arsenic	6.80E+00		3E-01	2E-02	—		3E-01
	Vanadium	3.77E+01		5E-01	1E-02	—		5E-01
Hazard Index Risk Drivers Across Soil				**8E-01**	**3E-02**	**0E+00**		**8E-01**
Groundwater	**Metals**							
	Arsenic	1.70E-02	—	4E+00				4E+00
	Selenium	3.80E-02	—	5E-01				5E-01
Hazard Index Risk Drivers Across Groundwater				**5E+00**				**5E+00**
Hazard Index Risk Drivers Across Soil Gas								**0E+00**
Hazard Index Risk Drivers Across All Media and All Exposure Routes				**5E+00**	**3E-02**	**0E+00**	**0E+00**	**5E+00**
Sitewide Hazard Index Across All Media and All Exposure Routes				**6E+00**	**3E-02**	**4E-03**	**2E-03**	**6E+00**

Notes:

[a] Units for soil concentrations are milligrams per kilogram (mg/kg), units for groundwater concentrations are milligrams per liter (mg/L) and units for soil gas are micrograms per cubic meter (µg/m³)
[b] Units for vapor phase are milligrams per cubic meter (mg/m³)

Acronyms/Abbreviations:
bgs – below ground surface
COPC – chemical of potential concern
EPC – exposure point concentration
U.S. EPA – United States Environmental Protection Agency

APPENDICES

APPENDIX A

BORING LOGS

HSA-1

BOREHOLE LOG

Client: Vulcan Anaheim Hills		Number: NO. 1 of 1	Sheet:
Date Started: 8/23/06	Date Finished: 8/23/06	Location: 9010 E. Santa Ana Canyon Road Anaheim, CA	
ILGRep: Mark Slatten, RG/CEG	Drill Rig/Sampling Method: CME-95	Borehole Dia.: 12"	Casing Dia.: NA
Casing Elevation (AMSL):			

SAMPLE LOG — Start Time: — BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0	ML	
HSA 1-1	1422	0.8	0	20/18/12	2		1', **SILT**, light yellowish brown (10YR 6/4), medium to fine, angular gravel to ¼", angular rx to 1" <25% by volume, rare small white bivalves to 2 mm, rootlets, dry loose, no odor. FILL DIRT
HAS 1-5	1441	0	0	2/4/8	5	ML	5' **SILT**, light brown (7.5YR 6/4), medium, not enough sample recovered for detailed description. dry, loose no odor FILL DIRT
HAS 1-10	1457	0.9	0	13/15/18	10	SP	10', **SAND**, reddish brown (5YR 5/4), fine-grained, poorly-graded, poorly-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1". angular rx to 3/4". arkosic, loose dry no odor. FILL DIRT.
HAS 1-15	1509	1.1	0	8/12/13	15	SP	15', **SAND**, dark yellowish brown (10 YR 4/6), fine-grained, poorly-graded, poorly-sorted, silty and gravelly with rounded pebbles to ½', angular rx to 3/4, arkosic loose, dry, no odor. FILL DIRT.
HAS 1-20	1523	1.5	0	12/28/32	20	ML	20', **SILT**, light brown (7.5YR 6/3), fine, sand (medium-grained) and gravel with rounded pebbles to ½", angular rx to 2" 25% of sample, one rx completely filled one end of the sampling tube, arkosic loose, dry, no odor. FILL DIRT.
HAS 1-25	1529	0.7	0	15/15/18	25	SP	25', **SAND**, reddish brown (5YR 5/4), fine-grained, poorly-graded, poorly-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1", angular rx to 1" arkosic, loose dry, no odor. FILL DIRT.
HAS 1-30	1541	1.6	0	33/55/60	30	ML	30', **SILT**, pinkish gray (7.5YR 7/2), fine, poorly-graded, poorly-sorted, sandy and gravelly with rounded pebbles to ½" angular rx to 2" <50% of sample, one rx completely filled one end of the sampling tube arkosic loose dry, no odor.
HAS 1-35	1550	3.0	0	8/13/19	35	SP	35', **SAND**, yellowish brown (10YR 5/6), medium-grained, very well-graded well-sorted rare gravel<5% by volume arkosic, loose, dry, no odor
HAS 1-40	1606	0.8	0	11/18/25	40	GW SP	40', **SAND**, yellowish brown (10YR 5/6), medium-grained, very well-graded, well-sorted, rare gravel<5% by volume, arkosic, loose WET, no odor

Bottom of boring 40'

rx=rock fragments

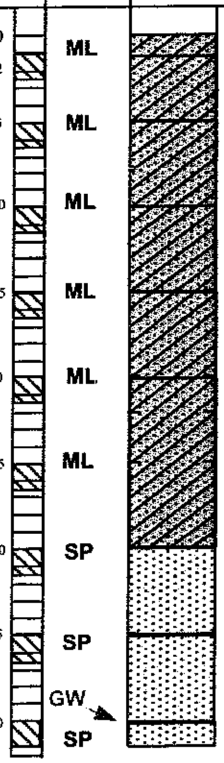
HSA-2

BOREHOLE LOG

Number:	NO. 1 of 1
Sheet:	
Client:	Vulcan Anaheim Hills
Location:	9010 E. Santa Ana Canyon Road, Anaheim, CA
Date Started:	8/24/06
Date Finished:	8/24/06
ILGRep:	Mark Slatten, RG/CEG
Drill Rig/Sampling Method:	CME-95
Borehole Dia.:	12"
Casing Dia.:	NA
Casing Elevation (AMSL):	
Start Time:	

SAMPLE LOG / BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
HSA 2-1	1003	0.4	0	8/15/13	2	ML	1', **SILT**, light yellowish brown (10YR 6/4), medium to fine, rare small white bivalves to 2 mm. rootlets, dry. loose, no odor.
HAS 2-5	1011	0.5	0	9/14/19	5	ML	5', **SILT** light yellowish brown (10YR 6/4), medium to fine, caliche as nodules to ½", rootlets, dry, loose no odor
HAS 2-10	1023	1.8	0	11/24/32	10	ML	10', **SILT**, very dark brown (10 YR 2/2), medium, rare angular rx to 1" <5% by volume organic. dry loose, no odor.
HAS 2-15	1037	3.7	0	17/22/25	15	ML	15', **SILT**, very dark brown (10 YR 2/2), medium, rare angular rx to 1" <5% by volume, yellowish red (5YR 5/8) oxidation as nodules to ¼' organic, dry, loose, no odor
HAS 2-20	1046	2.7	0	7/11/15	20	ML	20', **SILT**, dark grayish brown (10 YR 4/2), coarse, sand (medium to coarse-grained), with rounded pebbles to 1 ½" and angular rx to ½" to 20% of sample, loose dry, no odor.
HAS 2-25	1100			12/14/21	25	ML	25, **SILT**, dark yellowish brown (10 YR 4/6), coarse not enough sample for a comlete description loose, dry. no odor
HAS 2-30	1110			26/60/55	30	SP	30', **SAND**, light brown (7.5 Y 6/3), medium-grained, not enough sample for a complete description loose, dry, no odor.
HAS 2-35	1120	1.4	0	9/27/45	35	SP	35', **SAND**, light brown (7.5 Y 6/3), medium-grained, very well-sorted poorly-graded rare rounded pebbles to ½". rare angular rx to 1 ½" arkosic. loose dry, no odor.
HAS 2-40	1135	0.9	0	12/21/36	40	GW SP	40', **SAND**, dark brown (10 YR 5/2), medium-grained well-graded, poorly-sorted, pebbly and gravelly to 15% by volume, rounded pebbles to 1 ½", angular rx to 1 ½"poorly-graded. arkosic. loose, WET, no odor.



Bottom of boring 40'

rx=rock fragments

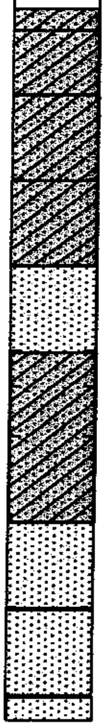
HSA-3

BOREHOLE LOG

Client: Vulcan Anaheim Hills		Number: NO. 1 of 1
		Sheet:
Date Started: 8/24/06	Date Finished: 8/24/06	Location: 9010 E. Santa Ana Canyon Road Anaheim, CA
TLGRep: Mark Slatten, RG/CEG	Drill Rig/Sampling Method: CME-95	Borehole Dia.: 12" ; Casing Dia.: NA ; Casing Elevation (AMSL):

SAMPLE LOG — Start Time: — BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
HSA 3-1	1420	0.9	0	7/7/9	2	ML	1', **SILT**, light yellowish brown (10YR 6/4), medium to fine very well-graded, compacted in sleeve to semi-indurated condition, rare small white bivalves to 2 mm, rootlets, dry loose, no odor
HAS 3-5	1435	0.7	0	12/5/7	5	ML	5', **SILT**, dark brown (10 YR 3/3), medium sand (medium-grained) with angular rx to 1/2" to 30 % by volume, organic, dry, loose, no odor
HAS 3-10	1445	1.9	0	9/17/25	10	ML	10', **SILT**, very dark brown (10 YR 2/2), medium, sand (medium-grained) with gravel to 1/8" to 5% by volume, organic dry loose no odor
HAS 3-15	1450	21.6	0	6/8/12	15	SP	15 , **SAND**, dark yellowish brown (10YR 4/4), medium-grained, poorly-graded, rounded pebbles and gravel to 5% by volume, rare angular rx to ½", arkosic, 1 large rounded pebble to 1" dry loose no odor.
HAS 3-20	1500	7.8	0	13/29/34	20	ML	20', **SILT**, dark yellowish brown (10 YR 4/6), coarse, not enough sample for a complete description loose. DAMP no odor.
HAS 3-25	1507	69.8	0	3/3/5	25	ML	25', **SILT**, dark yellowish brown (10 YR 4/6), coarse, rare sand (coarse-grained) to 1% by volume. rare rounded pebbles to 1/4", loose, dry, no odor
HAS 3-30	1520			11/14/19	30	SP	30', **SAND**, light brown (7 5 Y 6/3), medium-grained. not enough sample for a complete description, loose, dry, no odor.
HAS 3-35	1530			75 for 6"	35	SP	35 , **SAND**, light brown (7.5 Y 6/3), medium-grained, not enough sample for a complete description, loose dry, no odor
HAS 3-40	1540	7.8	0	12/15/24	40	GW SP	40', **SAND**, dark brown (10 YR 5/2), medium-grained, poorly-graded, rounded pebbles and gravel <5% by volume pebbles and angular rx to 1" arkosic, loose WET no odor



Bottom of boring 40'

rx=rock fragments

HSA-4

BOREHOLE LOG

Number: NO. 1 of 1

Sheet:

Client: **Vulcan Anaheim Hills**

Location: 9010 E. Santa Ana Canyon Road, Anaheim, CA

Date Started: 8/21/06

Date Finished: 8/21/06

TLGRep: Mark Slatten, RG/CEG

Drill Rig/Sampling Method: CME-95

Borehole Dia.: 12"

Casing Dia.: NA

Casing Elevation (AMSL):

Start Time:

SAMPLE LOG						BOREHOLE LOG	
Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0	ML	
HSA 4-1	0918	0	0	12/14/14	2		1', **SILT**, brown (10YR 5/3), medium sand (medium-grained) with gravel, angular rx to 1" and rounded pebbles to ¾" 40 % by volume. one rx to 2" across, , dry loose, no odor FILL DIRT
HAS 4-5	0920	0	0	7/8/8	5	ML ML	5', **SILT**, light brown (7.5YR 6/4), medium, not enough sample recovered for detailed description, dry. loose, no odor FILL DIRT.
HAS 4-10	0926	0	0	1/2/2	10	CL	10', **CLAY**, dark grayish brown (2.5 Y 4/2), fat, very sticky and plastic. DAMP, no odor; fine-grained sand 5 % by volume. FILL??
HAS 4-15	0935	1.6	0	2/4/6	15		15', **SILT**. dark yellowish brown (10 YR 4/6), fine-grained, sand (medium-grained) and gravel, rounded pebbles to ½". angular rx to 2" 50% of sample by volume, one rx completely filled one end of the sampling tube, five other rx to 1", arkosic, loose. dry, no odor. FILL DIRT.
HAS 4-20	0945	1.0	0	11/11/13	20	SP	20', **SAND**, dark yellowish brown (10 YR 4/6), fine-grained, poorly-graded, poorly-sorted, silty and gravelly with rounded pebbles to ½', angular rx to 2", one rx completely filled one end of the sampling tube, arkosic, loose dry, no odor
HAS 4-25	0954	0.4	0	8/15/18	25	SP	25', **SAND**, reddish brown (5YR 5/4), medium-grained, poorly-graded, well-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1/2", angular rx to 3/4" arkosic, loose DAMP, no odor
HAS 4-30	1006	0	0	38/80	30	SP	30', **SAND**, light brown (7.5 Y 6/3), medium-grained, not enough sample recovered for a detailed description, arkosic, loose, dry, no odor.
HAS 4-35	1014	0	0	17/22/24	35	SP	35', **SAND**, light brown (7.5 Y 6/3), medium-grained, not enough sample recovered for a detailed description. arkosic. loose dry, no odor.
						GW ➔	
HAS 4-40	1026	0.4	0	8/7/14	40	SP	40', **SAND**, light brown (7.5 Y 6/3), medium-grained, not enough sample recovered for a detailed description, arkosic, loose WET, no odor.

Bottom of boring 45'

rx=rock fragments

HSA-5

BOREHOLE LOG

Number:	NO. 1 of 1
Client:	Vulcan Anaheim Hills
Sheet:	
Location:	9010 E. Santa Ana Canyon Road Anaheim, CA
Date Started:	8/23/06
Date Finished:	8/23/06
ILGRep:	Mark Slatten, RG/CEG
Drill Rig/Sampling Method:	CME-95
Borehole Dia.:	12"
Casing Dia.:	NA
Casing Elevation (AMSL):	
Start Time:	

SAMPLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts
HSA 5-1	0953	0.2	0	7/21/29
HAS 5-5	1001	0.3	0	5/3/2
HAS 5-10	1008	0.2	0	1/2/2
HAS 5-15	1014	3.2	0	1/1/2
HAS 5-20	1026	2.9	0	50/41/55
HAS 5-25	1036	9.0	0	12/35/32
HAS 5-30	1047	0.6	0	8/17/25
HAS 5-35	1055	2.7	0	9/35/37
HAS 5-40	1108	0.4	0	9/18/24
HAS 5-40	DUPE			

BOREHOLE LOG

Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
0	ML	
2		1', **SILT**, brown (10YR 5/3), medium, sand (medium-grained) with gravel and rx to 1" to 40 % by volume dry loose, no odor. FILL DIRT.
5	ML	5', **SILT**, light brown (7.5YR 6/4), medium, sand (medium-grained) with rx to 1/2" to 30 % by volume. dry, loose, no odor. There is one 2" well-rounded pebble in the sample. FILL DIRT
10	ML	10', **SILT**, brown (10YR 5/3), not enough sample recovered for a complete description dry loose, no odor. FILL DIRT.
15	ML	15', **SILT**. brown (10YR 5/3), not enough sample recovered for a complete description, dry, loose no odor. FILL DIRT.
20	CL	20', **CLAY**, dark grayish brown (2.5 Y 4/2), fat, very sticky and plastic, DAMP, no odor; fine-grained sand 5 % by volume. FILL??
25	SP	25', **SAND**, dark brown (7.5 Y 5/3), medium-grained, poorly-graded, pebbly and gravelly to 50% by volume rounded pebbles to 1/2", rx to 1", arkosic, loose, DAMP no odor; and **SAND**, light brown (7.5 Y 6/3), medium-grained, well-graded, poorly-sorted, pebbly and gravelly to 40% by volume pebbles to 1/2". rx to 1" arkosic, loose, dry, no odor.
30	SP	30', **SAND**, light brown (7.5 Y 6/3), medium-grained, moderately well-graded, gravelly to 20% by volume, rare rounded pebbles to 1", rare angular rx to 1", arkosic, loose, dry, no odor
35	SP	35', **SAND**, light brown (7.5 Y 6/3), medium-grained, well-graded, poorly-sorted, pebbly and gravelly to 40% by volume, rounded pebbles to 1/2", rx to 1", arkosic, loose, dry no odor
40	GW SP	40', **SAND**, dark brown (7.5 Y 5/3), medium-grained, poorly-graded, pebbly and gravelly to 20% by volume, rounded pebbles to 1" arkosic, loose, DAMP, no odor
45	CL	45', **CLAY**, dark grayish brown (2.5 Y 4/2), fat, very sticky and plastic DAMP no odor; fine-grained sand 5 % by volume

Bottom of boring 45'

rx=rock fragments

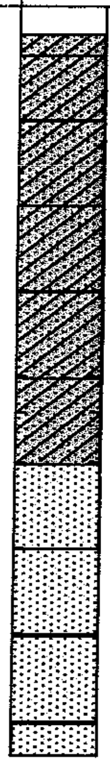
HSA-6

BOREHOLE LOG

Number:	NO. 1 of 1
Client:	Vulcan Anaheim Hills
Sheet:	
Location:	9010 E. Santa Ana Canyon Road Anaheim, CA
Date Started:	8/22/06
Date Finished:	8/22/06
ILGRep:	Mark Slatten, RG/CEG
Drill Rig/Sampling Method:	CME-95
Borehole Dia.:	12"
Casing Dia.:	NA
Casing Elevation (AMSL):	

SAMPLE LOG — Start Time: — BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0	ML	
HSA 6-1	1442	0.2	0	7/21/29	2		1', **SILT**, brown (10YR 5/3), medium, sand (medium-grained) with gravel and rx to 1" < 10 % by volume, dry, loose, no odor FILL DIRT.
HAS 6-5	1447			5/3/2	5	ML	5', **SILT**, light brown (7.5YR 6/4), medium, not enough sample recovered for a complete description, dry loose no odor FILL DIRT.
HAS 6-10	1454			1/2/2	10	ML	10', **SILT** brown (10YR 5/3), not enough sample recovered for a complete description, dry loose no odor. FILL DIRT.
HAS 6-15	1501			1/1/2	15	ML	15', **SILT** brown (10YR 5/3), not enough sample recovered for a complete description dry loose, no odor FILL DIRT.
HAS 6-20	1509			50/41/55	20	ML	20', **SILT**, brown (10YR 5/3), not enough sample recovered for a complete description, dry, loose, no odor. FILL DIRT.
HAS 6-25	1521			12/35/32	25	SP	25, **SAND**, dark brown (7.5 Y 5/3), medium-grained, not enough sample recovered for a complete description, loose, dry, no odor.
HAS 6-30	1531			8/17/25	30	SP	30', **SAND**, light brown (7.5 Y 6/3), medium-grained, not enough sample recovered for a complete description arkosic, loose dry, no odor
HAS 6-35	1539			9/35/37	35	SP	35', **SAND**, light brown (7.5 Y 6/3), medium-grained, not enough sample recovered for a complete description, arkosic, loose dry no odor.
HAS 6-40	1548			9/18/24	40	GW SP	40', **SAND**, dark brown (7.5 Y 5/3), medium-grained not enough sample recovered for a complete description, arkosic loose, WET, no odor



Bottom of boring 45'

rx=rock fragments

DPT-1

BOREHOLE LOG

Number:	NO. 1 of 1
Sheet:	
Client:	Vulcan Anaheim Hills
Location:	9010 E. Santa Ana Canyon Road Anaheim, CA
Date Started:	8/23/06
Date Finished:	8/23/06
ILGRep:	Mark Slatten, RG/CEG
Drill Rig/Sampling Method:	GEOPROBE 6600
Borehole Dia.:	2"
Casing Dia.:	NA
Casing Elevation (AMSL):	
Start Time:	

SAMPLE LOG / BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
DPT-1-1	0930				0–1	ML		1', **SILT**, light yellowish brown (10YR 6/4), medium to fine, rare small white bivalves to 2 mm, rootlets, dry, loose no odor.
DPT-1-5	0935				5	SP		5', **SAND**, light brown (7.5 Y 6/3), medium-grained, very well-sorted, poorly-graded, rare rounded pebbles to ½", rare angular rx to 1 ½", arkosic, loose, dry, no odor.
DPT-1-10	0948				10	SP		10', **SAND**, dark brown (10 YR 5/2), medium-grained, well-graded, poorly-sorted, pebbly and gravelly to 15% by volume, rounded pebbles to 1 ½', angular rx to 1 ½"poorly-graded, arkosic, loose, dry, no odor

Bottom of boring 10'

rx=rock fragments

DPT-2

BOREHOLE LOG

Number:	NO. 1 of 1
Sheet:	
Client:	Vulcan Anaheim Hills
Location:	9010 E. Santa Ana Canyon Road Anaheim, CA
Date Started:	8/23/06
Date Finished:	8/23/06
TLGRep:	Mark Slatten, RG/CEG
Drill Rig/Sampling Method:	GEOPROBE 6600
Borehole Dia.:	2"
Casing Dia.:	NA
Casing Elevation (AMSL):	
Start Time:	

SAMPLE LOG / BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0		
DPT-2-1	1032				1	ML	1', **SILT** light yellowish brown (10YR 6/4), medium to fine, very well-graded, compacted in sleeve to semi-indurated condition, rare small white bivalves to 2 mm, rootlets, dry loose no odor
DPT-2-5	1041				5	SP	5', **SAND**, dark brown (10 YR 3/3), silty medium-grained with angular r to 1/2" to 30 % by volume organic, dry loose, no odor
DPT-2-10	1056				10	SP	10', **SAND**, very dark brown (10 YR 2/2), silty, medium-grained with gravel to 1/8" to 5% by volume, organic, dry, loose, no odor

Bottom of boring 10'

rx=rock fragments

DPT-3

BOREHOLE LOG

Number: NO. 1 of 1

Sheet:

Client: **Vulcan Anaheim Hills**

Location: 9010 E. Santa Ana Canyon Road, Anaheim, CA

Date Started: 8/22/06

Date Finished: 8/22/06

TLGRep: Mark Slatten, RG/CEG

Drill Rig/Sampling Method: GEOPROBE 6600

Borehole Dia : 2"

Casing Dia : NA

Casing Elevation (AMSL):

SAMPLE LOG

Start Time:

BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0		
DPT-3-1	1432				1	ML	1', **SILT**, light yellowish brown (10YR 6/4), medium to fine, angular gravel to ¼", angular rx to 1" <25% by volume, rare small white bivalves to 2 mm, rootlets, dry, loose, no odor.
DPT-3-5	1445				5	SP	5', **SILT**, light brown (7.5YR 6/4) medium-grained gravelly poorly-sorted, dry loose, no odor
DPT-3-10	1455				10	SP	10', **SAND**, reddish brown (5YR 5/4), fine-grained, poorly-graded, poorly-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1", angular rx to 3/4" arkosic, loose, dry no odor.

Bottom of boring 10'

Note: Extreme moisture was detected in a soil vapor probe below 10' bgs at this location.

rx=rock fragments

DPT-4

BOREHOLE LOG

Number:	NO. 1 of 1
Sheet:	
Client:	Vulcan Anaheim Hills
Location:	9010 E. Santa Ana Canyon Road Anaheim, CA
Date Started:	8/22/06
Date Finished:	8/22/06
ILGRep:	Mark Slatten, RG/CEG
Drill Rig/Sampling Method:	GEOPROBE 6600
Borehole Dia :	2"
Casing Dia :	NA
Casing Elevation (AMSL):	

SAMPLE LOG — Start Time: — BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0		
DPT-4-1	0914				1	ML	1 , SILT, brown (10YR 5/3) medium, sand (medium-grained) with gravel, angular rx to 1" and rounded pebbles to ¾" 40 % by volume, one rx to 2" across, . dry, loose, no odor
DPT-4-5	0920				5	SP	5', SAND, dark yellowish brown (10 YR 4/6) fine-grained, poorly-graded, poorly-sorted, silty and gravelly with rounded pebbles to ½", angular rx to 2', one rx completely filled one end of the sampling tube arkosic loose WET, no odor.
DPT-4-10	0925				10	SP	10', SAND, reddish brown (5YR 5/4), medium-grained, poorly-graded, well-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1/2" angular rx to 3/4", arkosic, loose dry no odor

Bottom of boring 10'

rx=rock fragments

DPT-5

BOREHOLE LOG

Number: NO. 1 of 1	Sheet:	
Client: Vulcan Anaheim Hills	Location: 9010 E. Santa Ana Canyon Road, Anaheim, CA	
Date Started: 8/22/06	Date Finished: 8/22/06	
TLGRep: Mark Slatten, RG/CEG	Drill Rig/Sampling Method: GEOPROBE 6600	Borehole Dia.: 2"
Casing Dia.: NA	Casing Elevation (AMSL):	Start Time:

SAMPLE LOG / BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0		
DPT-5-1	1013				1	ML	1', **SILT**, brown (10YR 5/3) medium, sand (medium-grained) with gravel angular rx to 1" and rounded pebbles to ¾" 40 % by volume, one rx to 2" across. dry loose, no odor
DPT-5-5	1025				5	SP	5', **SAND**, reddish brown (5YR 5/4), medium-grained, poorly-graded, well-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1/2", angular rx to 3/4". arkosic, loose. dry no odor.
							8', **ASPHALT** black, degraded loose in sleeve. dry no odor.
DPT-5-10	1044				10	SP	10', **SAND**, reddish brown (5YR 5/4), medium-grained, poorly-graded, well-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1/2", angular rx to 3/4", arkosic, loose, dry no odor.

Bottom of boring 10'

rx=rock fragments

DPT-6

BOREHOLE LOG

Number: NO. 1 of 1

Sheet:

Client: **Vulcan Anaheim Hills**

Location: 9010 E. Santa Ana Canyon Road
Anaheim, CA

Date Started: 8/22/06

Date Finished: 8/22/06

ILGRep: Mark Slatten, RG/CEG

Drill Rig/Sampling Method: GEOPROBE 6600

Borehole Dia.: 2"

Casing Dia.: NA

Casing Elevation (AMSL):

SAMPLE LOG — Start Time: — BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0		
DPT-6-1	1122				1	ML	1', **SILT**, brown (10YR 5/3), medium, sand (medium-grained) with gravel and rx to 1" < 10 % by volume, dry, loose, no odor.
DPT-6-5	1130				5	SP	5', **SAND**, reddish brown (5YR 5/4), medium-grained, poorly-graded, well-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1/2", angular rx to 3/4". arkosic, loose, dry, no odor, AND **ASPHALT** black, degraded, loose in sleeve, dry. no odor
DPT-6-10	1140				10	SP	10', **SAND**, reddish brown (5YR 5/4), medium-grained, poorly-graded, well-sorted, pebbly and gravelly < 10% by volume, rounded pebbles to 1/2", angular rx to 3/4" arkosic, loose, dry no odor.

Graphic Log

Bottom of boring 10'

rx=rock fragments

DPT-7

BOREHOLE LOG

Number: NO. 1 of 1	Sheet:	
Client: Vulcan Anaheim Hills		
Date Started: 8/22/06	Date Finished: 8/22/06	Location: 9010 E. Santa Ana Canyon Road Anaheim, CA
ILGRep: Mark Slatten, RG/CEG	Drill Rig/Sampling Method: GEOPROBE 6600	Borehole Dia.: 2" / Casing Dia.: NA / Casing Elevation (AMSL):

SAMPLE LOG — Start Time: — BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0			
DPT-7-1	1220				1	ML		1, SILT, brown (10YR 5/3), medium, sand (medium-grained) with gravel and rx to 1" to 40 % by volume, dry, loose. no odor.
DPT-7-5	1230				5	SP		5', SAND, dark brown (7.5 Y 5/3), medium-grained, poorly-graded, pebbly and gravelly to 50% by volume, rounded pebbles to 1/2". rx to 1, arkosic, loose, dry, no odor.
								6', ASPHALT black degraded, loose in sleeve dry, no odor
								8', WET
DPT-7-10	1240				10	SP		10', SAND, dark brown (7.5 Y 5/3), medium-grained, poorly-graded, pebbly and gravelly to 50% by volume, rounded pebbles to 1/2". rx to 1 arkosic, loose DAMP no odor; and

Bottom of boring 10'

rx=rock fragments

DPT-8

BOREHOLE LOG

Number: NO. 1 of 1

Sheet:

Client: **Vulcan Anaheim Hills**

Location: 9010 E. Santa Ana Canyon Road
Anaheim, CA

Date Started: 8/22/06

Date Finished: 8/22/06

ILGRep: Mark Slatten, RG/CEG

Drill Rig/Sampling Method: GEOPROBE 6600

Borehole Dia.: 2"

Casing Dia.: NA

Casing Elevation (AMSL):

SAMPLE LOG

Start Time:

BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth in Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Components, Moisture, Density, Odor, Etc.)
					0		
DPT-8-1	**1414**				1	**ML**	1', **SILT**, brown (10YR 5/3) medium, sand (medium-grained) with gravel and rx to 1" to 40 % by volume dry, loose, no odor.
						CL	
DPT-8-5	**1416**				5		5', **CLAY**, dark grayish brown (2.5 Y 4/2), fat, very sticky and plastic, DAMP, no odor; fine-grained sand 5 % by volume; AND
						SP	**SAND**, light brown (7.5 Y 6/3), medium-grained, well-graded, poorly-sorted, pebbly and gravelly to 40% by volume rounded pebbles to 1/2" rx to 1", arkosic, loose, dry, no odor.
DPT-8-10	**1418**				10	**SP**	10', **SAND**, dark brown (7.5 Y 5/3), medium-grained, poorly-graded, pebbly and gravelly to 50% by volume, rounded pebbles to 1/2", rx to 1" arkosic, loose, DAMP, no odor.

Bottom of boring 10'

rx=rock fragments

DPT-9

BOREHOLE LOG

Number: NO. 1 of 1

Sheet:

Client: **Vulcan Anaheim Hills**

Location: 9010 E. Santa Ana Canyon Road, Anaheim, CA

Date Started: 8/22/06

Date Finished: 8/22/06

ILGRep: Mark Slatten, RG/CEG

Drill Rig/Sampling Method: GEOPROBE 6600

Borehole Dia.: 2"

Casing Dia.: NA

Casing Elevation (AMSL):

Start Time:

SAMPLE LOG / BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0	ML		
DPT-9-1	**1450**				1	SP		1', **SILT**, light yellowish brown (10YR 6/4), medium to fine rare small white bivalves to 2 mm. rootlets, dry, loose, no odor.
								5', **SAND**, light brown (7.5 Y 6/3), medium-grained, well-graded, poorly sorted, pebbly and gravelly to 40% by volume, rounded pebbles to 1/2" rx to 1" arkosic, loose, dry, no odor.
DPT-9-5	**1520**				5	SP		
DPT-9-10	**1530**				10	SP		10', **SAND**, dark brown (7.5 Y 5/3), medium-grained, poorly-graded, pebbly and gravelly to 50% by volume rounded pebbles to 1/2", rx to 1" arkosic, loose, DAMP, no odor

Bottom of boring 10'

rx=rock fragments

DPT-10

BOREHOLE LOG

Number:	NO. 1 of 1
Sheet:	
Client:	Vulcan Anaheim Hills
Location:	9010 E. Santa Ana Canyon Road Anaheim, CA
Date Started:	8/22/06
Date Finished:	8/22/06
TLGRep:	Mark Slatten, RG/CEG
Drill Rig/Sampling Method:	GEOPROBE 6600
Borehole Dia.:	2"
Casing Dia.:	NA
Casing Elevation (AMSL):	

SAMPLE LOG — Start Time: — BOREHOLE LOG

Sample Number	Sample Time	OVA/PID (ppm)	gases (ppm)	Blow Counts	Depth In Feet	USCS Symbol	Geologic Description (Soil Type, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					0		
DPT-10-1					1	ML	1', **SILT**, light yellowish brown (10YR 6/4), medium to fine rare small white bivalves to 2 mm rootlets, dry loose, no odor.
						SP	
DPT-10-5					5	SP	5', **SAND**, light brown (7.5 Y 6/3), medium-grained, well-graded, poorly sorted, pebbly and gravelly to 40% by volume, rounded pebbles to 1/2" rx to 1", arkosic, loose dry, no odor
DPT-10-10					10	SP	10', **SAND**, dark brown (7.5 Y 5/3), medium-grained, poorly-graded, pebbly and gravelly to 50% by volume, rounded pebbles to 1/2" rx to 1" arkosic, loose, DAMP, no odor.

Bottom of boring 10'

rx=rock fragments

APPENDIX B

SAMPLE PROTOCOLS FOR THE THREE MEDIA

DRILLING AND SAMPLING PROTOCOLS

Soil boring, soil vapor, and groundwater locations will be marked or staked in the field. Utility clearance will be requested for each drilling location to identify any subsurface utilities prior to drilling and sampling. No borings will be drilled within 5 feet of marked underground utility lines or within 10 feet of active overhead power lines. Boring locations will be adjusted, as necessary.

The work area will be prepared by placing plastic sheeting on the ground to avoid cross-contamination. Prior to drilling all drilling and sampling equipment will be steam-cleaned or cleaned with an Alconox-water solution, rinsed with tap water, and then rinsed with de-ionized (DI) water. This equipment includes all drill pipe, split-spoon samplers, sleeves, and tools. After cleaning is completed, equipment will be placed on plastic or otherwise segregated to prevent cross-contamination until used. Equipment wash water will be stored on-site in sealed, labeled, 55-gallon steel drums. Wash water will be profiled and disposed of at an appropriate facility. A clean pair of new disposable gloves should be worn each time a different location is sampled, and gloves should be donned immediately before sampling. Following collection of environmental samples at each location, the borehole will be grouted to ground surface using bentonite grout and completed at ground surface to match existing surface conditions.

Soil vapor sampling will be conducted following the *Advisory for Active Soil Gas Investigations* published by the Department of Toxic Substances Control (DTSC) and the Regional Water Quality Control Board (RWQCB), Los Angeles Region (2003).

DIRECT PUSH TECHNOLOGY (DPT)

SOIL VAPOR SAMPLING

Soil vapor samples will be collected using direct-push test (DPT) methodology. DPT rigs depend upon the static weight of the trucks they are mounted on to push/hammer pipe into the ground. DPT rigs typically push a hollow steel rod 1 7/8-inches in outer-diameter (called "A-rod") with a hydraulic oil-actuated hammer. The total depth (TD) attainable by DPT rigs is dependent upon many factors; however gravel, pebbles, and cobbles generally result in "refusal". The soil vapor sampling system has a retractable screen located behind the drive tip. A new tip and well screen will be used for each sample location. When the target depth is reached, the A-rods are pulled up about 2 inches, exposing the screen to the subsurface. Teflon® tubing is threaded down the push rods. A special threaded fitting at the end of the tubing is screwed into the top of the screen. Hydrated bentonite will be used to achieve a seal at the surface of each sampling probe. Leak detection will be conducted at each sample location using isopropanol at potential leak points in the sampling device. The tubing is purged of ambient air. Samples are collected by gas-tight glass and Teflon syringes and hand-carried to a mobile laboratory on site.

A Geoprobe™ Model 5600 push rig will be used to collect all 5- and 15 foot samples. Deeper samples may be collected by DPT depending upon coarseness of the soil.

SOIL MATRIX SAMPLING

Depth discrete soil samples are acquired with a California modified split-spoon sampler that is driven into the ground to the required depth via A-rods. The sampler is lined with brass or stainless steel sample rings (usually 3 or 4 2-inch-diameter by 6-inch-long sample rings called "sleeves"). A drive point is attached to a rod which threads through the hollow sampler and is locked into place. When the sampler is driven to the proper soil sample depth, the steel pin is unlocked. After the pin is unlocked, the sampler is driven downwards and fills with soil. The sampler is then retrieved and the sleeves extruded. The sampling person will be wearing a fresh pair of nitrile gloves. Sample sleeves will be full – air space at the end of the tubes may result in lost volatile chemical compounds. If there is an air space, it should be filled with cuttings from the same sampling horizon, or some inert soil, or, as a last resort, any available soil. This is said with the realization that in the lab, the soil from the sleeve will be extruded and sampled from the middle part of the tube. The site geologist will cap the bottommost sleeve with Teflon sheets and plastic end caps immediately after acquisition. The field name, date, time, and analyses will be written on both ends of the sample (on the end caps) in indelible ink. For orientation, an arrow may be written so as to indicate the top or bottom of the sample. Related samples should be "bagged" in large freezer bags, preferably the "Ziploc" variety. The bags are then placed in a cooler filled with *ICE*. The "blue ice" that is available rarely keeps the cooler at 4°C as it should be. The other sleeves are utilized for head-space analysis or for lithologic description.

For a continuous core, the sampling barrel is lined with clear acetate, which fills up with soil as the barrel is driven into the ground. Coring barrels (and other samplers) are generally 1.5- to 3-feet in length and range from 1- to 3-inches in diameter. The coring barrel is retrieved and the acetate liner extruded. The site geologist examines the liner and selects a portion to be sent to the lab for analysis, based upon lithology, color, odor, etc. The remainder of the acetate liner is utilized for head-space analysis or for lithologic description (see below). A lithologic log will be prepared using the Uniform Soil Classification System (USCS) visual-manual procedure (ASTM D2488-90) by a TLG field geologist.

GROUNDWATER SAMPLING

A boring will be drilled to a depth approximately to top of groundwater. DPT rod will then be placed inside the auger and pushed to total depth (TD) of 3 feet below groundwater. The groundwater sampling system has a retractable screen located behind the drive tip. A new tip and well screen will be used for each sample location. The A-rod will be retracted to allow groundwater to enter through the screen into the borehole. A bailer will then be lowered slowly until it contacts water surface and allowed to sink and fill with a minimum of surface disturbance. The bailer will be slowly raised to the surface. Neither the bailer line nor the bailer will be allowed to contact the ground. Water samples will be stored in 40-mL vials with septum inserts and screw caps. The septum should be placed on the sample vial so that the PTFE side is in contact with the sample. The 40-mL vials will be completely filled to prevent volatilization. Extreme caution will be exercised when filling a vial to avoid any turbulence that could also produce volatilization. The sample will be carefully poured down the side of the vial to minimize turbulence. The last few drops will be gently added to the vial so that the surface tension holds the water in a convex meniscus. The cap will be screwed on tightly and some overflow lost, but air space in the bottle will be eliminated. After the bottle is capped, it will be turned over and tapped to check for bubbles. If any bubbles are present, the procedure will be repeated. Care will be taken to ensure that no loss of preservative occurs. Repeat these steps as needed to acquire sufficient volume to fill all sample containers. Disposal bailers with bottom-emptying devices, one per well, and equipped with new string, will be used. Each sample bottle will be labeled with an appropriate label annotated with all the necessary information. Each filled sample container will be bagged and placed on ice for the trip to the laboratory. A chain-of-custody (COC) will be filled out prior to delivery to the lab. Pertinent information will be recorded in a field book.

HOLLOW STEM AUGER

SOIL VAPOR

Deeper soil vapor samples will be collected by use of a hollow stem auger (HAS). HSA drill rigs are generally truck-mounted and diesel-powered. Each 5-foot-long auger flight consists of a hollow center pipe wrapped with cutting blades in a "corkscrew" fashion (hence the name "hollow stem"). The string of connected flights is rotated and pressed down by hydraulic rams to penetrate the subsurface. The bit is slightly larger than the diameter of the drill string and is armed with peg-like "teeth" that grind the soil into soil cuttings. The spinning auger flight moves drill cuttings upwards to the surface, which clears the soil cuttings from the borehole.

A boring will be drilled to a depth approximately 5 feet above the soil vapor sampling depth. Bentonite will be used to seal the boring at this depth. DPT rod will then be placed inside the auger and pushed 5 feet to total depth (TD). The soil vapor sampling system has a retractable screen located behind the drive tip. A new tip and well screen will be used for each sample location. When the target depth is reached, the A-rods are pulled up about 2 inches, exposing the screen to the subsurface. Teflon® tubing is threaded down the push rods. A special threaded fitting at the end of the tubing is screwed into the top of the screen. Soil vapor sampling will occur at least 20 minutes after the boring is completed to allow equilibrium to be reached. The system will then be purged of ambient air (the purge volume will be determined by a purge test). Purge and sampling rates will be between 100- and 200 milliliters per minute (ml/min) to limit stripping and ambient air dilution. Samples being transported to the mobile lab on site will be collected in gas-tight Teflon and glass syringes. Confirmation samples will be collected in 1-liter Summa™ canisters. Soil vapor sampling will not be conducted during or within 24 hours of a significant rain event (greater than 0.5 inch). Soil vapor samples will be labeled with a unique sample identifier designating the location and depth (e.g., SG-1-5). Soil samples will be labeled with a unique sample identifier designating the location and depth (SB1-5) and delivered to Associated Laboratories of Orange, California under TLG's chain-of-custody procedures.

SOIL MATRIX SAMPLING

Soil matrix sampling through HAS is very similar to the description above (DPT Soil Matrix). The exception is that blow counts are usually tracked at each sampling level to give a rough estimate of lithology. Blow counts are the number of times a 40-pound weight is dropped 18 inches on the sampler A-rod to drive it 6 inches into the ground. Sample handling is identical to the description above (ibid).

GROUNDWATER SAMPLING

The SOP for sampling groundwater through auger flight is explained above in the section on **DPT – Groundwater sampling**.

SAMPLING EQUIPMENT

The following equipment may be used to conduct environmental sampling:

Chemical resistant gloves
Appropriate personal protection equipment (PPE, Level D or greater)
Spray paint and stakes
Plastic sheeting
Duct tape
Summa™ canisters
Bailers and string
Sealable (generally Ziplock®) plastic bags
New polybuterate, brass, or stainless steel sample liners
Plastic end caps and Teflon® tape
Sample labels
Evidence Tape
Photoionization detector (PID)
Cooler and ice
Decontamination equipment
Notebook and camera
Indelible ink pens
Writing pens

Tool box
Drum labels

Department of Toxic Substances Control

Linda S. Adams
Secretary for
Environmental Protection

Maureen F. Gorsen, Director
5796 Corporate Avenue
Cypress, California 90630

Arnold Schwarzenegger
Governor

July 26, 2006

Mr. Brian Anderson
Director of Environmental Affairs
Vulcan Materials Company
Western Division
3200 San Fernando Road
Los Angeles, California 90065

CONDITIONAL APPROVAL OF THE SITE INVESTIGAITON WORK PLAN, FORMER INDUSTRIAL ASPHALT PLANT, 9010 EAST SANTA ANA CANYON ROAD, ANAHEIM, CALIFORNIA 92808

Dear Mr. Anderson:

The Department of Toxic Substances Control (DTSC) has reviewed the Site Investigation Work Plan (SIWP) for the subject site, prepared by the Leu Group, dated July 3, 2006. The purpose of the SIWP is to propose to DTSC a detailed investigation of the subsurface beneath the site. The SIWP identifies data gaps and proposes to fill the gaps with soil matrix, soil vapor, and groundwater sampling results from beneath strategic locations on site. This information will be used with existing data that have previously been collected by other parties to evaluate the threat to State waters and to determine if the site poses a risk above acceptable levels for residential development.

Based on the data presented, DTSC has identified some deficiencies in the submitted SIWP that require additional information/modification. However, in order to expedite the implementation of the field work, DTSC conditionally approves the SIWP. The conditions are specified in the enclosed comments. Following are a few highlights of some of the important issues need to be addressed:

1. A proposal for the public participation activities should be included in the final revised SIWP;
2. At least one of the groundwater samples collected in the vicinity of the potential source area should be analyzed for polychlorinated biphenyls (PCBs); and
3. Polynuclear aromatic hydrocarbons (PAHs) should be analyzed using US EPA Method 8310; and
4. A more comprehensive analyses and listing of volatile organic compounds (VOCs) should be proposed instead of those found on Table 3-2j.

5 Please incorporate all the conditions and requirements specified in this letter and the attached memorandum from DTSC's Human and Ecological Risk Division, and submit the revised SIWP by August 26, 2006, for DTSC's review and concurrence. Please submit a tentative schedule of activities to DTSC as soon as possible, and inform DTSC at least five (5) working days in advance of field activities so that DTSC staff can be present at the site during field activities.

Please note that Santa Ana Regional Water Quality Control Board (RWQCB) should be notified if perchlorate is detected in the underlying groundwater during this phase of investigation and a copy of the Site Investigation Report submitted to RWQCB for their evaluation and review.

If you have any questions or need additional information regarding this correspondence, please contact Mr. Johnson P. Abraham, Project Manager at (714) 484-5476 or me at (714) 484-5463.

Sincerely,

J.T. Liu, Unit Chief, P. E.
Southern California Cleanup Operations Branch
Cypress Office

Enclosure

cc: Mr. Brian Ferris
Vulcan Materials Company, Western Division
3200 San Fernando Road
Los Angeles, California 90065

Dr. David Leu, Ph.D., President
The Leu Group
33725 Magellan Isle, Suite 100
Monarch Beach, California 92629

Mr. Kamron Saremi
Santa Ana Regional Water Quality Control Board
3737 Main Street, Suite 500
Riverside, CA 92501-3348

COMMENTS ON
THE SITE INVESTIGATION WORK PLAN (SIWP)
FOR THE FORMER INDUSTRIAL ASPHALT PLANT SITE
9010 EAST SANTA ANA CANYON ROAD, SANTA ANA, CALIFORNIA 92808

The Department of Toxic Substances Control (DTSC) has reviewed the Site Investigation Work Plan (SIWP) for the subject site. The SIWP is generally prepared in accordance with DTSC's standards and guidelines. However, several areas in the SIWP require modifications/revisions and additional information. The SIWP is reviewed by the Geological Services Unit and the Human Ecological Risk Division in addition to the Project Manager. For your review and response, DTSC's comments on the SIWP are as follows:

General Comments

1. Community Profile: During the development of the SIWP, it was communicated with Dr. David Leu that a Community Profile should be included with the SIWP. In response to Dr. Leu's request it was recommended to state in the SIWP that a community assessment will be conducted concurrently and the summary will be provided in the final Site Investigation Report. As indicated earlier, please refer to Section 2.2.2 Community Profile in the PEA Guidance Manual. The Guidance Manual states, "<u>The community profile is submitted to the Department for review and approval prior to initiation of filed activities at the site.</u> The profile will be used to determine the public notification activities to be conducted prior to the initiation of sampling activities at the site and during any remedial activities." Therefore, if you at least start with a community assessment now, you will be able to put the summary in the final report. Moreover, further remedial activities will not be delayed just because of the public participation activities. No Preliminary Endangerment Assessment (PEA) was conducted at the site under the oversight of DTSC. The previous PEA was an equivalent report. Several previous investigation reports were submitted to DTSC as a PEA equivalent report. No sampling activities were conducted during the PEA review. Since the PEA was recommended for further action, there were no questions of a Community Profile during the PEA activity. It should be completed as a part of the supplemental investigation. The Leu Group needs to consult with a Public Participation Specialist regarding this issue.

2. Archeological and Paleontological Resources: The SIWP states that the Irvine Company property area as "culturally sensitive". It also states that several fossil localities have been recorded on the Irvine Company property. During sampling activities and any further onsite removal or remedial actions, any evidence of archeological and paleontological resources should be closely monitored, and

DTSC should be notified immediately if any evidence is found at the site. An archeologist's presence may be more appropriate during any onsite activities.

Specific Comments

Section 1.0: Introduction

- Please identify the locations of the Irvine Company, Owl Rock Products Company, Robertson's Ready Mix, R.F. White Company, etc., on Figure 1-2. DTSC recommends that a larger size figure should be provided to locate specific structures and sample locations.

Section 3.4.7: Industrial Asphalt's Site Groundwater Quality

- Figure should be provided in larger size. For example, GWMW-1, GWMW-2 and GWMW-3 are difficult to locate in Figure 3-1.

Section 3.5.4: Conceptual Site Model (CSM)

- Contaminants of principal concern (COPCs) known in groundwater are listed twice for benzene, toluene, ethylbenzene and xylenes (BTEX).

Section 4.2: Field Activities

- USEPA Method 8270 is listed for polycyclic aromatic hydrocarbons (PAHs). DTSC prefers USEPA Method 8310 instead of USEPA Method 8270.

- Table 3-2c indicates analysis of soil for PCBs using USEPA Method 8082. However, it is not listed in the text.

- Table 3-2 indicates analytical methods of all COPCs in soil except for PAHs (Table 3-2e). Please identify the method for PAHs in Table 3-2e. In the text it is identified as USEPA Method 8270. However, DTSC recommends USEPA Method 8310. See HERD's comments for more information.

- For groundwater, USEPA Method 8270 is recommended for analyzing PAHs. There is no mentioning in the text regarding groundwater analysis for PAHs. Please rectify this error.

- At a minimum, one groundwater sample should be analyzed for polychlorinated biphenyls (PCBs). This sample should be collected from a hydro-punch location in the vicinity of the former transformer.

- Pager 21, paragraph 1 states, "A list of chemicals of potential concern at the site (COPCs) and other and other compounds that will be reported from analysis of soil matrix samples are provided as Tables 3-2f—3-2i." This may be a typographical error. It should be corrected. The Tables 3-2—3-2i is for groundwater analysis rather that soil matrix samples. Also, the repetition of "and other" should be corrected.

Appendix 1: Quality Assurance Project Plan (QAPP)

- USEPA Method 8310 is not mentioned Section 1.9, Analytical Procedures of the QAPP. USEPA Method 8310 has to be mentioned here.

Appendix 2: Health & Safety Plan

- The Health & Safety Plan should be signed by the Project Manager.

Attachments:

Memorandum dated July 26, 2006, from Dr. Byran Eya, Ph.D., Staff Toxicologist, Human and Ecological Health Division, to Mr. Johnson Abraham, Project Manager.

Department of Toxic Substances Control

Linda S. Adams
Secretary for
Environmental Protection

Maureen F Gorsen, Director
1001 "I" Street
P.O. Box 806
Sacramento, California 95812-0806

Arnold Schwarzenegger
Governor

MEMORANDUM

TO: Johnson Abraham
Project Manager
Department of Toxic Substances Control
Southern California Cleanup Operations Branch
Cypress, CA 90630

FROM: Bryan K. Eya, Ph.D
Staff Toxicologist
Human and Ecological Risk Division (HERD)

DATE: July 26, 2006

SUBJECT: Site Investigation Work Plan
Former Industrial Asphalt Plant Site
9010 East Santa Ana Canyon Road
Anaheim, California

PCA: 12020 Site: 401036-11

Background

Per your technical service request, the Human and Ecological Risk Division (HERD) reviewed the Site Investigation Work Plan for the Former Industrial Asphalt Plant Site in Anaheim. This site is approximately 2.5 acres and is a part of a larger parcel which is an active quarry operation owned by the Irvine Company (TIC), which was subleased to Owl Rock Products Company (Owl Rock). Owl Rock subsequently subleased this property to Industrial Asphalt Company and R.F. White Trucking Facility. Industrial Asphalt occupied the southern half of this Owl Rock site, and used this property as a batch asphalt manufacturing operation since 1950 until 1995. The northern half of this property was used as a fueling center and truck storage location until 1990 by R.F. White Trucking (RFW Facility). The former underground storage tanks (USTs) at the Industrial Asphalt and RFW facilities were removed and soil from the vicinity thermally treated and backfilled in 1994-1996. These former USTs included the diesel fuel USTs, asphalt tanks used for manufacturing of batch asphalt and gasoline USTs. A layer of oily material was left in place beyond the extent of the excavation. This site investigation work plan outlines the procedure for further site characterization in accordance with the Voluntary Cleanup Agreement between DTSC and the Vulcan Materials Company. The previous investigations indicated that this site was impacted by chemicals of potential concern (COPCs) such as total petroleum hydrocarbon in diesel range (TPHd) and motor oil range (TPHmo), BTEX (benzene, toluene, ethylbenzene and xylene), methyl tertiary butyl ether (MTBE) and polycyclic aromatic hydrocarbon (PAHs).

HERD previously provided technical support and has reviewed the following documents: (1)

Revised Summary of Historical Activities and Site Investigation Work Plan (July 19, 2001); (2) July 19, 2001 Revised Summary of Historical Activites and Site Investigation Work Plan (November 6, 2001); (3) Response to Comments to the Revised Summary (November 20, 2001); (4) Site Investigation Report (April 19, 2002); (5) Preliminary Endangerment Assessment (PEA) Documentation-Human Health Screening Evaluation (May 24, 2004); (6) Comments on the PEA prepared by Riz Sarmiento (October 31, 2002); (7) Soil and Groundwater Sampling Data (9 November 2004); (8) Revised Summary of Historical Activities and Site Investigation Work Plan (July 19, 2001); (9) Site Investigation Report (April 19, 2002); (10) E-mail from K. Arteaga of GeoSyntec concerning the Industrial Asphalt Development Plan (6/28/2005, 12:09PM); and (11) Proposed Revisions to the Soil Gas Work Plan provided via e-mail (6/24/2005, 1:09:31 AM) from Ann Holbrow, received 6/27/2005.

Document Reviewed

Site Investigation Work Plan, Former Industrial Asphalt Plant Site, 9010 East Santa Ana Canyon Road, Anaheim, CA; Prepared and Submitted to Department of Toxic Substances Control, On Behalf of Vulcan Materials Company, San Fernando Road, Los Angeles, CA; Prepared by The Leu Group, Monarch Beach, CA; July 2006.

General Comments

In general, HERD considers that work plan to be acceptable with several modifications as provided below. HERD recommends that the statements made in text and corresponding tables in this report be examined for agreement and appropriate corrections be made particularly in regards to the methodologies to be used for site characterization and method detection limits.

1 Table 3-2j: HERD recommends that a more comprehensive analyses and listing of VOCs be provided than those found on Table 3-2j. There are only 21 VOCs listed in Table 3-2j when Method 8260B (http://www.epa.gov/epaoswer/hazwaste/test/pdfs/8260b.pdf) list as many as 105 VOCs in their compound list. HERD recommends that soil gas analyses which are scheduled to be performed using Methods 8260B and TO15 include the majority if not all of the volatile organics and oxygenates listed for the Method 8260B.

   Although the method detection limit (MDL) of 1 ug/L for Method 8260B may be appropriate for initial screening when evaluating for all target VOCs, HERD recommends additional sampling and analyses be performed using MDL of 0.1 ug/L if any target VOCs are detected, and to confirm the non-detect of carcinogenic VOCs (see: page 16 of the Advisory – Active Soil Gas Investigation http://www.dtsc.ca.gov/LawsRegsPolicies/Policies/SiteCleanup/upload/SMBR_ADV_activesoilgasinvst.pdf). HERD request that a clarification be provided for the difference in MDLs listed on Table 3-2j (MDL = 1 ug/L) versus the MDL = 0.1 ug/L as quoted in text (Page 21).

   HERD recommends that ten percent of soil vapor confirmation samples collected in SUMMA™ canister include locations where the highest VOC concentrations were detected during the onsite 8260B/mobile lab analyses. Furthermore, HERD recommends that tracer compound breakthrough into samples be minimized as much as possible (i.e., non-detect or not greater than MDL).

2. Page 21, Para 2: HERD recommends that the soil gas sampling and analyses be preformed both for the native soil and within the backfill. Furthermore, HERD requests that a clarification be provided for what seems to be an inconsistency between the language provided in the text

and details provided in Figure 3-1, i.e., "TLG's intent here is to sample native soil and not backfill", versus Figure 3-1 includes soil matrix/soil vapor/GW sampling locations within the previously excavated area shown as "red dots"

HERD recommends that extra care be provided in soil vapor sampling at depths less than 5 ft bgs, if performed, due to the increased potential for barometric pumping (see: Vapor Intrusion Guidance, page 5).

3. Page 22, Para 1: HERD recommends that the DTSC Johnson & Ettinger (J&E) Model (i.e., Screening-Level Model for Soil Gas Contamination) be used for vapor intrusion modeling which is found in the following website: http://www.dtsc.ca.gov/AssessingRisk/JE_Models.cfm

4. Page 22, Section 6.0: HERD recommends that the maximum soil gas concentrations be used for the J&E modeling to make a site-specific evaluation for future buildings instead of the 95% upper confidence limit (95% UCL) as described in Section 6.0 of this report (i.e., see Vapor Intrusion Guidance, page 22 under "Future Buildings"). Also, an appropriate default values for the soil gas advection rate (Q_{soil} = 5 L/min) for future building should be used.

5. Section 4.2, Page 20: HERD recommends that Method 8310 be used instead of 8270, if the analyses described in Section 4.2 are meant for polycyclic aromatic hydrocarbons (PAHs). Although 8270 is a more robust method in detecting a wider range of semi-volatile organic chemicals (SVOCs) including PAHs, the detection limit is frequently too elevated for quantitating carcinogenic PAHs. HERD would like to point out another inconsistency between the method for PAHs described in text (i.e., Method 8310 according to Page 22, Para 1 versus 8270 as mentioned on Page 20 of this report).

Specific Comments

1. Section 1.0; Page 1: HERD notes that the acreage of the former Industrial Asphalt "the Site" of this investigation has changed from 4 acres as described in the Site Investigation Report (April 19, 2002) and Soil and Groundwater Sampling Data (November 9, 2004) to approximately 2.5 acres as mentioned in this report. HERD request that an explanation be provided for this change in acreage.

2. Page 16, Para 1; Figure 3-1: HERD request that a better figure be provided with clearer markings of previous wells, soil sampling locations and test pit locations for those shown on Figure 3-1. HERD notes that location of ST-1 cannot be found on Figure 3-1.

3. Page 19; Tables 3-2a to 3-2j: HERD notes that Tables "3a" through "3j" as described in text are referring to Tables "3-2a" to "3-2j" in the tables section of this report.

Recommendations and Conclusion

In general, HERD considers the work plan to be acceptable with several modifications. HERD recommends that the soil gas be analyzed more comprehensively for the majority of VOCs and oxygenates as listed in Method 8260B and these VOCs be listed in the subsequent report for Methods 8260B and TO15. Furthermore, HERD recommends that the screening-level model for soil gas with maximum VOCs concentrations and Q_{soil} = 5 L/min be used for the J&E indoor-air modeling, and Method 8310 be used for the analyses of PAHs. Although HERD read the entire document, the focus of this review was on those sections that may affect the health risk assessment. HERD assumes that other DTSC staff has also reviewed this work plan, particularly with respect to the adequacy of site characterization procedures outlined in this report, quality assurance project plan (QAPP), drilling and sampling protocols, and health and safety plan. The recommendations made in this document are site specific and should not be construed as a policy decision applicable to other sites. If you have additional questions please feel free to call me at (916) 255-6629, or Dr Gerald A. Pollock at (916) 255-6648

Reviewed by: Gerald A. Pollock, Ph.D. Gerald A. Pollock
Senior Toxicologist, HERD

IndustrialAsphalt_07_05_06 doc

STATE OF CALIFORNIA
ENVIRONMENTAL PROTECTION AGENCY
DEPARTMENT OF TOXIC SUBSTANCES CONTROL

In the Matter of: Former Industrial Asphalt Site Project Proponent Vulcan Materials Company Western Division 3200 San Fernando Road Los Angeles, California 90065	Docket No HSA-A 02/03-005 Voluntary Cleanup Agreement Addendum Health and Safety Code Section 25355.5(a)(1)(C)

I Introduction

1.1 Parties The California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) entered into Voluntary Cleanup Agreement (Agreement) Docket No. HSA-A 02/03-0052 with the Vulcan Materials Company, Western Division (Proponent) on October 20, 2002. The Agreement Addendum will extend the scope of work of the original Agreement, as described in Exhibit A and will correct the site description shown in Section 1.2 of the original VCA

1.2 Site The property which is the subject of this Agreement (Site) is located at 9010 East Santa Ana Canyon Road, Anaheim, Orange County, California 92808, and is known as the Former Industrial Asphalt Site. The property was subleased from the Owl Rock Products Company and the size was outlined as the "sublicense boundary" in their sub-agreement (Figure 1). The property consists of approximately 2.132 acres as calculated by the proponent on the basis of the digitized, scaled map, and is identified by Assessor's Parcel Number(s) 514-012-008 (Figure 2) This Agreement Addendum will address additional investigation for soil, soil vapor and groundwater at the Site, which is of a concern to both DTSC and the Proponent.

1.3 Jurisdiction This Agreement is entered into by DTSC and the Proponent pursuant to Health and Safety Code (H&SC) section 25355.5(a)(1)(C). This section authorizes DTSC to enter into an enforceable agreement with Proponents to oversee the characterization and cleanup of a Site.

1.4 Purpose Proponent and DTSC desire that Proponent commence activities leading to a supplemental investigation and risk characterization in a safe and expeditious manner, under the oversight of DTSC. The purpose of this Agreement Addendum is for DTSC to provide oversight for a supplemental investigation and a human health risk evaluation. The purpose of this Agreement Addendum is also for DTSC to obtain reimbursement from the Proponent for DTSC's oversight costs.

II Background

The background is described in the original Agreement. The Agreement Addendum is being implemented to conduct a supplemental investigation and a human health risk evaluation. Exhibit A outlines the Scope of Work for this Agreement Addendum.

III Agreement

All provisions outlined and agreed by both DTSC and the Proponent in the original Agreement will apply to this Agreement Addendum.

Thomas M. Cota, Branch Chief, Site Mitigation and Brownfields Reuse Program, Southern California Cleanup Operations, Cypress, is designated by DTSC as its Manager for this Agreement. Brian Anderson, Director of Environmental Affairs, Western Division, Vulcan Materials Company is assigned by the Proponent as its Manager for this Agreement Addendum. As indicated in the original Agreement, each Party to this Agreement shall provide at least ten (10) days advance written notice to the other of any change in its designated manager.

Refer to Exhibit B as the Cost Estimate for DTSC oversight for the Agreement Addendum The advance payment of $14,278 shall be made no later than ten (10) days after this Agreement Addendum is fully executed All payments made by the Proponent pursuant to the terms described in the original Agreement shall be by a cashier's or certified check or a check drawn on Proponent's account made payable to the "Department of Toxic Substances Control", and bearing on its face the project code for the Site (Calstars Site Code #401036 (11 WP) and the docket number (Docket No HSA-A 02/03-005) of this Agreement. Payments shall be sent to:

Department of Toxic Substances Control
Accounting/Cashier
1001 I Street, 21st Floor
P.O. Box 806
Sacramento, California 95812-0806

A photocopy of the check shall be sent concurrently to DTSC's Agreement Manager.

Date: 7/14/06

Thomas M. Cota, Chief
Southern California Cleanup Operations Branch - Cypress Office
Site Mitigation and Brownfields Reuse Program

Date: 7/7/06

Brian Anderson, Director of Environmental Affairs - Western Division
Vulcan Materials Company